EXHIBIT "A"

I, the undersigned, who have prepared English translation which is attached herewith, hereby declare that the aforementioned translation is true and correct translation of officially certified copy of the Korean Patent Application No. 10-2002-0085858 filed on December 28, 2002.

Translator: ________________

Yong-Kyoo LEE

Date: January 20, 2010

KOREAN INTELLECTUAL PROPERTY OFFICE

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Date of Application:	December 28, 2002
Application Number:	Patent Application No. 10-2002-0085858
Applicant(s):	POSCO

COMMISSIONER

APPLICATION FOR PATENT

10-2002-85858

To the Commissioner of
the Korean Intellectual Property Office

REFERENCE NO:	0025
FILING DATE:	December 28, 2002
TITLE:	Method for Compacting Reduced Fine Ore in Plate Form and Method for Manufacturing Compaction for Melter Gasifier Using Compacted Fine Ore
APPLICANT:	POSCO
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Submitted herewith is an application identified above pursuant to Article 42 of the Patent Act.

□yAbstract□z

The present invention relates to a method for manufacturing thick compacted materials of fine reduced irons with a plate form, which can be continuously produced during manufacturing of molten iron using raw coals and fine iron ores. In addition, the present invention relates to a method for manufacturing compacted materials for being used in a melter-gasifier by using the compacted materials with a plate form.

According to the present invention, in a process for manufacturing molten iron using raw coals and fine iron ores, a method for manufacturing compacted materials of fine reduced irons with a plate form and a method for manufacturing compacted materials for being used in a melter-gasifier by using the compacted materials comprising a step of arranging grooves of the left and right press rolls with a suitable gap therebetween to be offset with each other; and a step of manufacturing compacted materials with a plate form by charging and pressing mixture of the hot fine reduced irons and calcined additives or only hot fine reduced irons discharged from a final reduction reactor of fluidized-bed reduction reactors into a gap formed between the left and right press rolls while rotating them along a direction opposing to each other, thereby manufacturing the compacted materials with a plate form are provided. A surface of the left and right press rolls includes flat portions and the grooves.

The present invention has an effect to improve not only productivity but also efficiency of a process for manufacturing molten iron.

□yRepresentative Drawing□z

FIG. 2

□yKeyword□z

fluidized-bed reduction reactor, melter-gasifier, fine reduced iron, calcined additive, compacted material

□ySpecification□z

□yTitle□z

Method for compacting reduced fine ore in plate form and method for manufacturing compaction for melter-gasifier using compacted fine ore

□yBrief description of the drawings□z

FIG. 1 is a conceptual view of a process for manufacturing molten iron including an embodiment of an apparatus for manufacturing hot compacted materials; a fluidized-bed reduction reactor for reducing fine iron ores; and a melter-gasifier for producing molten iron and slag by charging raw coals and reduced irons thereinto to realize the present invention.

FIG. 2 is a detailed view of an entire process of the apparatus for manufacturing hot compacted materials including a hot storage installation for storing fine reduced irons and calcined additives; an apparatus for charging fine reduced irons; and an apparatus for manufacturing hot compacted materials including crusher and so on.

FIG. 3 is a detailed sectional view of a charging bin provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives in order to manufacture compacted materials with a plate form according to the present invention.

FIG. 4 is a structural view of a hot press part provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives in order to manufacture compacted materials with a plate form according to the present invention wherein a) shows an outer perspective view of the hot press part and b) shows a detailed sectional view of the press roll.

FIG. 5 is a detailed view of a compacted shape of the fine reduced irons and calcined additives pressed by a roll tyre of the press roll provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives in order to manufacture compacted materials with a plate form according to the present invention.

FIG. 6 is a hot press part and a hot crushing part provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives in order to manufacture compacted materials with a plate form according to the present invention.

FIG. 7 is a perspective view of a crushing roll including a hot crushing part for crushing compacted materials with a plate form into compacted material for being used in the melter-gasifier according to the present invention.

FIG. 8 is a detailed view of a hot branching part provided in the hot crushing part for crushing compacted materials with a plate form into compacted material for being used in the melter-gasifier according to the present invention wherein a) shows a left sectional view and b) shows a right sectional view.

FIG. 9 is a detailed view of an apparatus for cooling and transferring compacted materials provided in the hot crushing part for crushing compacted materials with a plate form into compacted material for being used in the melter-gasifier according to the present invention.

FIG. 10 is a longitudinal sectional view of a hot separation part provided in the hot crushing part for crushing compacted materials with a plate form into compacted material for being used in the melter-gasifier according to the present invention.

FIG. 11 is a horizontal sectional view of a second crushing part provided in a hot crushing part for crushing compacted materials with a plate form into compacted material for being used in the melter-gasifier according to the present invention.

FIG. 12 is a horizontal sectional view of a structure of the second crushing part provided in a hot crushing part for crushing compacted materials with a plate form into compacted material for being used in the melter-gasifier according to the present invention.

FIG. 13 is a longitudinal sectional view of a structure of the second crushing part provided in a hot crushing part for crushing compacted materials with a plate form into compacted material for being used in the melter-gasifier according to the present invention.

FIG. 14 is a detailed view of a hot transferring part provided in a hot crushing part for crushing compacted materials with a plate form into compacted material for being used in the melter-gasifier according to the present invention wherein a) is a side view and b) is a detailed sectional view.

FIG. 15 is a systematic view of wet scrubber provided in a hot crushing part for crushing compacted materials with a plate form into compacted material for being used in the melter-gasifier according to the present invention.

FIG. 16 is a schematic view of a fluidized-bed reduction reactor for reducing fine iron ores according to a conventional art and a process for manufacturing molten iron including a melter-gasifier manufacturing molten iron and slag by charging raw coals and reduced irons thereinto.

FIG. 17 is a schematic view of conventional press rolls and the compacted materials manufactured by using the press rolls wherein a) shows a press roll and b) shows compacted materials.

FIG. 18 is a schematic view of other conventional press rolls and the compacted materials manufactured by using the press rolls wherein a) shows a press roll and b) shows compacted materials.

FIG. 19 is a schematic view of press rolls and the compacted materials manufactured by using the press rolls in accordance with the present invention wherein a) shows a press roll; b) shows compacted materials pressed by press rolls which are arranged for their grooves to be offset with each other according to the present invention; and c) shows compacted materials pressed by press rolls which are arranged for their grooves to be correspond with each other.

* explanation of reference numerals of the main part shown in the drawings *

1. apparatus for manufacturing hot compacted materials
5. pressured transferring pipe
10. hot storage bin
12. apparatus for controlling level
17. transfer/block valve
18a. plate
18b. hydraulic actuator
20. charging bin
26a, 26b. charging device
28a, 28b. charging member
30a, 30b. electric motor
32. hot pressing part
36a, 36b. press roll
38a, 38b. hydraulic motor
40. hydraulic pressing part
42a. body shaft
42b. roll tyre
44. cooling water
50. hot crushing part
54. crushing plate
54a. spacer ring
56. protrusion
60. hot branching part
62. hollow type housing

68. separation plate
70. hydraulic cylinder
80. cooling and transferring device
82. water container
86, 88. pan conveyor
90. belt
95. storage tank
100. hot separation part
102. inlet port
106. casing
110. spring
112. vibrator
115. fine particle outlet port
120. second hot crushing part
122. disc type blade
124. spacer ring
126. tie bolt
130a, 130b. cylindrical crushing roll
134. central axis
150. hot transferring part
152. bucket
154. chain
156. compacted materials loading part
158. compacted materials unloading part
160. driving motor
170. tunnel
180. hot storage part
190. charging device
200. wet dust collector
210. wet scrubber
212. moisture remover
300. pre-heater
310. pre-reduction reactor
320. final reduction reactor
330. fluidized-bed reduction reactor
340. melter-gasifier

C. compacted materials

□yDetailed description of the invention□z

□yObject of the invention□z

□yTechnical field to which the invention belongs and background of the technical field□z

<59> The present invention relates to a method for manufacturing compacted materials of fine reduced irons with a plate form, which can be continuously produced with further thickness thereof during manufacturing of molten iron using raw coals and fine iron ores. In addition, the present invention relates to a method for manufacturing compacted materials for being used in a melter-gasifier by using the compacted materials with a plate form.

<60>¡¦<80> omitted

□yTechnical object of the invention□z

<81> In the present invention regarding a process for manufacturing molten iron by using raw coals and fine iron ores, mixture of the hot fine reduced irons and calcined additives or only hot fine reduced irons discharged from a fluidized-bed reduction reactor are pressed under a suitable pressing condition. Therefore, the object of the present invention is to provide a method for manufacturing compacted materials of fine reduced irons with a thick plate form without split or breaking which can minimize an amount of dusts.

<82> Another object of the present invention is to provide compacted materials for being used in the melter-gasifier with a strength, density and size distribution thereof suitable for being melted and slagging in the melter-gasifier by roll pressing and crushing fine reduced irons under a suitable pressing condition.

□yConstitution of the invention□z

<83> The present invention will be explained as follows.

<84> The present invention relates to a method for manufacturing compacted materials of fine reduced irons with a plate form, which can be continuously produced with further thickness thereof during manufacturing of molten iron using raw coals and fine iron ores. In addition, the present invention relates to a method for manufacturing compacted materials for being used in a melter-gasifier by using the compacted materials with a plate form comprising

<85> a step of arranging grooves of the left and right press rolls with a suitable gap therebetween to be offset with each other. A surface of the left and right press rolls includes flat portions and the grooves; and

<86> a step of manufacturing compacted materials with a plate form by charging and pressing mixture of the hot fine reduced irons and calcined additives or only hot fine reduced irons discharged from a final reduction reactor of fluidized-bed reduction reactors into a gap formed between the left and right press rolls while rotating them along a direction opposing to each other, thereby manufacturing the compacted materials with a plate form are provided.

<87> In addition, a method for manufacturing compacted materials for being used in a melter-gasifier in a process for manufacturing molten iron by using raw coals and fine iron ores in an apparatus for manufacturing molten iron including multi-staged fluidized-bed reduction reactors for reducing the fine ores; and a packed type melter-gasifier for manufacturing molten iron by using the fine reduced irons comprising

<88> a step of arranging grooves of the left and right press rolls with a suitable gap therebetween to be offset with each other, a surface of the left and right press rolls comprising flat portions and the grooves;

<89> a step of manufacturing compacted materials with a plate form by charging and pressing mixture of the hot fine reduced irons and calcined additives or only hot fine reduced irons discharged from a final reduction reactor of the fluidized-bed reduction reactors into a gap formed between the left and right press rolls while rotating them along a direction opposing to each other, thereby manufacturing the compacted materials with a plate form; and

<90> a step of crushing the manufactured compacted materials in order to have a shape and mechanical property which are suitable for being charged into the melter-gasifier.

<91> The present invention will be explained in detail as follows.

<92> The present invention is preferably applied to a process for manufacturing molten iron by using raw coals and fine iron ores in an apparatus for manufacturing molten iron including multi-staged fluidized-bed reduction reactors for reducing the fine ores; and a packed type melter-gasifier for manufacturing molten iron by using the fine reduced irons.

<93> According to the present invention, the grooves of the left and right press rolls are arranged to have a suitable gap therebetween to be offset with each other in order to manufacture compacted materials with a plate form. A surface of the left and right press rolls includes flat portions and the grooves.

<94> It is preferable that each flat portion of a surface of the left and right press rolls is formed to have a length of a range from 1mm to 5mm along a direction parallel to a rotating direction of the press rolls; and the a depth of the groove of the surface of the

press roll is in a range from 3mm to 15mm and a distance between the grooves is in a range from 20mm to 50mm.

<95> In addition, it is preferable that a section breaking the groove along a direction to be horizontal to a rotating direction of the roll has a rounded arc shape and has a line shape along a direction to be perpendicular to a rotating direction of the roll.

<96> The offset distance between the left and right press rolls is preferably in a range from 50% to 70% of the distance between the grooves.

<97> As described above, after the left and right press rolls are arranged, mixture of the hot fine reduced irons and calcined additives or only hot fine reduced irons discharged from a final reduction reactor of the fluidized-bed reduction reactors are charged and pressed into a gap formed between the left and right press rolls while rotating them along a direction opposing to each other, thereby manufacturing the compacted materials with a plate form are manufactured.

<98> As a material manufactured into a compacted material with a plate form can be hot fine reduced irons or mixture of the hot fine reduced irons and calcined additives.

<99> As an example of using hot fine reduced irons as a material manufactured into compacted materials with a plate shape can be those discharged from a final reduction reactor of the fluidized-bed reduction reactors after the fine iron ores are charged into the multi-staged fluidized-bed reduction reactors.

<100> In addition, an example of using the mixture of the hot fine reduced irons and calcined additives as compacted material with a plate form can be those discharged from a final reduction reactor of the fluidized-bed reduction reactors after the fine iron ores and additives are charged into the multi-staged fluidized-bed reduction reactors

<101> An amount of the calcined additives in the mixture of the hot fine reduced irons is preferably in a range from 3wt% to 20wt% of the total amount of the compacted materials.

<102> The calcined additives play a role to prevent the fine reduced irons from sticking to the press roll. However, the amount thereof is too less, it is impossible to expect the above role thereof and combination property of the compacted materials is deteriorated since an amount of the fine reduced irons playing a role to render a sticking property if the amount thereof is too much. Therefore, an amount of the calcined additives is preferably limited in a range from 3wt% to 20wt% of the total amount of the compacted materials.

<103> The pressing temperature is preferably set to be in a range from 400¡æ to 800¡æ. The reasons are as follows. A sticking property of the compacted material is deteriorated if the pressing temperature is too low. The fine reduced iron can be stick

to a surface of the press roll if the pressing temperature is too high.

<104> The pressing pressure is preferably set to be in a range from 140bar to 250bar during the roll pressing. The reasons are as follows. The density thereof not only becomes too high but also it is not necessary to consume such energy if the pressing pressure is too high. The strength thereof is further reduced and then particles are severely generated if the pressing pressure is too low.

<105> A pressing condition is preferably set to make a density of the compacted material be in a range from 3.5ton/m³ to 4.2ton/m³ and make a thickness thereof be in a range from 3mm to 30mm when the compacted material .is pressed according to the present invention.

<106> The compacted materials with a plate form manufactured like above are crushed to have a shape and mechanical property which are suitable for being charged into the melter-gasifier in order to manufacture compacted materials according to the present invention.

<107> The compacted materials manufactured like above have an irregular shape with a density of a range from 3.5ton/m³ to 4.2ton/m³ and a size not more than 50mm, preferably 30mm.

<108> More preferably, a size distribution of the compacted materials for being used in the melter-gasifier is not more than 20% with a size of a range from 30mm to 50mm; at a range from 10% to 40% with a size of a range from 30mm to 50mm; at a range from 10% to 40% with a size of a range from 10mm to 20mm; at a range from 5% to 30% with a size of a range from 1mm to 10mm; and at a range not more than 10% with a size of not more than 1mm.

<109> The present invention will be explained in detail with reference to FIGs. 1 to 15.

<110> First, the apparatus for manufacturing compacted materials, which corresponds with the present invention, for compacting hot fine reduced irons and calcined additives; and then manufacturing compacted materials are explained.

<111> An embodiment of the apparatus for manufacturing hot compacted materials for compacting hot fine reduced irons and calcined additives is shown in FIGs. 1 to 5.

<112> As shown in FIG. 1, the apparatus for manufacturing hot compacted materials 1 is located between the final reduction reactor 320 and the melter-gasifier 340.

<113>…<117> omitted

<118> As shown in FIG. 3, in the hot charging devices 26a and 26b, two sets of spiral type charging members 28a and 28b are slanted at both sides of the charging bin 20 to a direction to be perpendicular direction and arranged toward a lower end outlet port of the charging bin 20. The electric motors 30a and 30b are provided to rotate and

drive the charging members 28a and 28b at an upper end of the charging bin 20.
<119> The spiral type charging members 28a and 28b are installed above the left and right press rolls 36a and 36b, which will be explained below, and make a charging amount of the fine reduced irons be the same as that of the calcined additives.
<120>, <121> omitted
<122> A hot press roll 32, which presses the fine reduced irons and calcined additives into a plate form, is connected to the lower end of the charging bin 20.
<123>, <124> omitted
<125> In addition, the press rolls 36a and 36b are successively arranged at a lower portion of the charging members 28a and 28b and thereby pressing the fine reduced irons and calcined additives into a plate form while being rotated along a direction opposing to each other.
<126>…<129> omitted
<130> In addition, as shown in FIG. 5, the surface of the roll tyre 42b consists of a flat portion and a groove which are alternately formed to be located.
<131> The left press roll 36a and the right press roll 36b are arranged to have a suitable gap therebetween. In addition, the groove formed on a surface of the roll tyre 42b of the left press roll 36a is arranged to be offset with the groove formed on a surface of the roll tyre 42b of the left press roll 36b.
<132> Each flat portion of a surface of the roll tyre 42b of the left and right press rolls 36a and 36b is preferably formed to have a length of a range from 1mm to 5mm along a direction parallel to a rotating direction of the press rolls. In addition, a depth of the groove of the surface of the press roll is preferably in a range from 3mm to 15mm and a distance between the grooves is preferably in a range from 20mm to 50mm.
<133> The offset distance between the left and right press rolls is preferably in a range from 50% to 70% of the distance between the grooves.
<134> By forming and arranging the press roll like above, the sheet of the compacted materials suitable for being crushed in the hot crushing part 50, which will be explained below, is formed.
<135> omitted
<136> When the hot press roll 32 presses the fine reduced irons and calcined additives, pressed compacted materials with a plate form is manufactured.
<137> omitted
<138> A crushing device for crushing the manufactured compacted materials according to the present invention in order to have a shape and mechanical property which are suitable for being charged into the melter-gasifier will be explained.

<139> As shown in FIG. 6, a hot crushing part 50 is located under the hot press rol 32 successively connected thereto. The hot crushing part 50 separates and crushes the fine reduced irons and calcined additives C with a plate form to have a size suitable for being charged into the melter-gasifier 340.
<140> The hot crushing part 50 is a device for firstly separating and crushing the compacted materials C made of the fine reduced irons and calcined additives pressed by the hot press roll 32 as a size suitable for being charged into the melter-gasifier 340.
<141>...<154> omitted
<155> Meanwhile, a hot separation part 100 is provided to successively connect with the discharging port 66b of the hot branching part 60 and separate large grains contained in the firstly crushed hot compacted materials made of the fine reduced irons and calcined additives.
<156> The hot separation part 100 is connected to the hot crushing part 7 and separates compacted materials C made of the fine reduced irons and calcined additives with a size of not less than 50mm, preferably not less than 30mm after the compacted materials C are crushed. The hot separation part 100 can separate the compacted materials C at a maximum rate of 120ton/h. As shown in FIG. 10, the hot separation part 100 separates a grain with a size of not less than 50mm, preferably not less than 30mm by vibrating the compacted materials C made of the fine reduced irons and calcined additives charged through an inlet port 102 of the upper portion. The inlet port 102 is formed at an upper portion of a casing 106 including a slanted screen 104 and a large grain discharging port 108 is formed at an opposing side of the inlet port 102.
<157> omitted
<158> Therefore, such hot separation part 100 discharges the compacted materials C with a size of not less than 50mm, preferably not less than 30mm through the large grain discharging port 108 and discharges the rest compacted materials C with a small size through the small grain discharging port 115. In addition, a second hot crushing part 120, which will be explained below, is arranged under the large grain discharging port 108. A hot transferring part 150 is connected to a lower portion of the small grain discharging port 115 in order to transfer the crushed hot compacted materials C made of the fine reduced irons and calcined additives.
<159> As entirely shown in FIG. 11, the second hot crushing part 120, which is connected to the large grain discharging port 108, is successively connected to the hot separation part 100. The second hot crushing part 120 separates and crushes the separated compacted materials C made of fine reduced irons and calcined additives

with a large grain size to be suitable for being charged into the melter-gasifier 340.
<160>...<165> omitted

<166> The second hot crushing part 100, which is connected to the large grain discharging outlet 108 of the hot separation part 100, crushes compacted materials C made of the fine reduced irons and calcined additives with a size over 50mm, preferably over 30mm suitable for being charged into the melter-gasifier 340. The second hot crushing part 100 can crush the compacted materials C at a maximum rate of 60ton/h. It is possible to variably control a rotating times and a gap between the impact blades 122 in order to minimize the amount of the fine particles generated during crushing of compacted materials C made of the fine reduced irons and calcined additives.

<167>...<172> omitted

<173> Meanwhile, when hot compacted materials C made of fine reduced irons and calcined additives contact with atmosphere in the apparatus for manufacturing compacted materials 1 for realizing the above present invention, heat is generated to be fired by re-oxidation of the hot compacted materials which reacts with oxygen. Therefore, it is necessary to make inert atmosphere.

<174> Therefore, a nitrogen injection line (not shown) is installed in each of the devices in order to prevent the compacted materials C from being oxidized and operation is carried out under a state of reducing concentration of oxygen. Therefore, natural firing of the compacted materials C is prevented.

<175> As an example, nitrogen injection lines can be installed at transfer/blocking valve 17, hot press part 32, hot crushing part 50, second hot crushing part 120 and hot transferring part 150. Constitution, function and effect of the nitrogen injection lines can be easily understood by the skilled art, detailed description thereof is omitted.

<176> In addition, wet dust collector 200 is installed to collect hot dusts generated in a process of transferring, charging, crushing and separating of the compacted materials C made of the fine reduced irons and calcined additives in the apparatus for manufacturing hot compacted materials 1 according to the present invention.

<177> As shown in FIG. 15, dust collectors (not shown) are installed in each of the hot press part 32, a hot crushing part 50, a cooling and transferring device 80, a hot separation part 100, a second hot crushing part 120, a hot transferring part 150 and so on. They are connected to a wet scrubber 210 and a moisture remover 212 through a pipe, thereby discharging residues through a chimney 214 after the dusts are removed.

<178> Constitution, function and effect of the wet dust collector can be easily understood by the skilled art, detailed description thereof is omitted.

<179> A method for manufacturing compacted materials made of fine reduced irons and calcined additives with a plate form by using the apparatus for manufacturing hot compacted materials as shown in FIGs. 1 to 5 and a method for crushing the compacted materials with a plate form by using the crusher as shown in FIGs. 6 and 7 are explained below.

<180>…<185> omitted

<186> As shown in FIG. 5, compacted materials C made of fine reduced irons and calcined additives with a plate shape corresponding to the present invention manufactured by rotating a pair of press rolls, namely the left and right press rolls 36a and 36b with a suitable gap therebetween along a direction opposing to each other by using hydraulic motors 3a and 38b while arranging the groove formed on a surface of the roll tyre 42b of the left press roll 36a and the groove formed on a surface of the roll tyre 42b of the right press roll 36b to be offset.

<187> It is preferable that each flat portion of a surface of the left and right press rolls is formed to have a length of a range from 1mm to 5mm along a direction parallel to a rotating direction of the press rolls; and the a depth of the groove of the surface of the press roll is in a range from 3mm to 15mm and a distance between the grooves is in a range from 20mm to 50mm.

<188> The offset distance between the left and right press rolls is preferably in a range from 50% to 70% of the distance between the grooves.

<189> An amount of the calcined additives in the mixture of the hot fine reduced irons and calcined additives is preferably in a range from 3wt% to 20wt% of the total amount of the compacted materials.

<190> The pressing temperature is preferably set to be in a range from 400¡æ to 800¡æ. The pressing pressure is preferably set to be in a range from 140bar to 250bar during the roll pressing.

<191> A density of the compacted material C made of fine reduced irons and calcined additives is in a range from 3.5ton/m^3 to 4.2ton/m^3 and a thickness thereof is in a range from 3mm to 30mm according to the present invention.

<192> omitted

<193> In the present invention, compacted materials are pressed by forming grooves on a surface of the roll tyre 42b of the press rolls 36a and 36b and arranging the groove formed on a surface of the roll tyre 42b of the left press roll 36a and the groove formed on a surface of the roll tyre 42b of the right press roll 36b to be offset, thereby a problem of a split of the plate type compacted materials with a thickness over 8mm does not happen.

<194>…<196> omitted

<197> The compacted materials for being used in the melter-gasifier manufactured like above have an irregular shape with a density of a range from 3.5ton/m^3 to 4.2ton/m^3 and a size not more than 50mm, preferably 30mm.

<198> More preferably, a size distribution of the compacted materials for being used in the melter-gasifier is not more than 20% with a size of a range from 30mm to 50mm; at a range from 10% to 40% with a size of a range from 30mm to 50mm; at a range from 10% to 40% with a size of a range from 10mm to 20mm; at a range from 5% to 30% with a size of a range from 1mm to 10mm; and at a range not more than 10% with a size of not more than 1mm.

<199> Meanwhile, an amount of generated fine particles is increased

<202>, <203> omitted

<204> The hot separation part 100 separates a grain with a size of not less than 50mm, preferably not less than 30mm. The grain with a size of not less than 50mm, preferably not less than 30mm is discharged through a large grain discharging outlet port 108 while grain with a size of not more than 50mm, preferably not more than 30mm is discharged through a small grain discharging outlet port 115.

<205> In addition, hot compacted materials for being used in a melter-gasifier with a size of not less than 50mm, preferably not less than 30mm discharged from the large grain discharging outlet port 108 have gone through the a couple of cylindrical crushing rolls 130a and 130b which rotates by the hydraulic motors 132 of the second hot crushing part 120 and then are crushed into a size thereof not more than 50mm, preferably not more than 30mm. and are capable of being charged into the melter-gasifier 340.

<206> In addition, hot compacted materials for being used in a melter-gasifier crushed with a size of not more than 50mm, preferably not more than 30mm, which have gone through the second hot crushing part 120, and the hot compacted materials for being used in a melter-gasifier crushed with a size of not more than 50mm, preferably not more than 30mm, which have gone through a small grain discharging outlet 115 of the hot separation part 100 are loaded into a plurality of buckets 152 of the hot transferring part 150. The buckets 152 are transferred upward by the plurality of chains driven by an operation of the driving motor 160 provided in the compact materials unloading part 158 located at an upper side.

<207> In addition, hot compacted materials for being used in a melter-gasifier crushed with a size of not more than 50mm, preferably not more than 30mm, which is transferred by the hot transferring part 150 are loaded into the hot storage bin 180 and

then are charged into the melter-gasifier 340 through a plurality of hot pressure equalizing containers 192 and 194 of the charging device 190.

<208> omitted

<209> The dusts of the compacted materials made of fine reduced irons and calcined additives are collected through dust collectors (not shown) are installed in each of the hot press part 32, a hot crushing part 50, a cooling and transferring device 80, a hot separation part 100, a second hot crushing part 120, a hot transferring part 150 and so on. The dusts pass through a wet scrubber 210 and a moisture remover 212 by using a pipe, thereby residues are discharged through a chimney 214 after the dusts are removed.

<210> The present invention is specifically explained with reference to the embodiment below.

<211> Embodiments

<212> The compacted materials with a plate form are manufactured by using a roll press with a surface shape shown in FIGs. 17(a)(flat roll), 18(a)(roll with a groove) and 19(a)(roll of the present invention) by using fine reduced irons and calcined additives of 750¡æ discharged from the final reduction reactor of the fluidized-bed reduction reactor.

<213> The compacted materials with a flat form manufactured by each of the rolls are shown in FIGs. 17(b), 18(b), 19(b) and 19(c).

<214> FIG. 19(b) shows compacted materials with a flat form manufactured by arranging a pair of press rolls to make their grooves to be offset and FIG. 19(c) shows compacted materials with a flat form manufactured by arranging a pair of press rolls to make their grooves to correspond with each other.

<215> A thickness, a density, productivity and dust generating rate of the compacted materials manufactured by using each of the press roll are investigated and a result thereof is shown in Table 1 below.

<216> □yTable 1□z

	flat roll (FIG. 17a)	roll with a groove (FIG. 18a)	roll of the present invention (FIG. 19b) (the grooves are arranged to be offset)
Thickness (mm)	8	10	16

Density (g/cm^3)	3.8	3.8	3.8
Productivity (%)	100	120	200
Dust generating rate (-1mm, wt%)	10	8	5

<217> As described in Table 1, productivity is increased and dust generating rate is known to be reduced below 5% since the flat type compacted materials with a thickness of 16mm can be manufactured when compacted materials with a flat form are manufactured according to the present invention.

<218> Especially, when the press rolls are arranged by making their grooves to correspond with each other, split and breaking phenomenon are severely appeared as shown in FIG. 19(c).

<219> In addition, the split phenomenon was severely happened due to an increase of sticking property between the fine reduced irons and the roll when the press rolls with grooves were used.

□yEffect of the invention□z

<220> As described above, the present invention can manufacture thick plate type compacted materials made of fine reduced irons with a minimized generating amount of dusts without split and breaking in a process for manufacturing molten iron by using raw coals and fine iron ores, thereby productivity and efficiency of a process for manufacturing molten iron can be improved.

<221> In addition, the present invention provides compacted materials for being used in the melter-gasifier with a strength, density and size distribution thereof suitable for being melted and slagging in the melter-gasifier, thereby having an effect that improved productivity and efficiency of a process for manufacturing molten iron are promoted.

□yWhat is claimed is□z

1. A method for manufacturing compacted materials with a plate form in a process for manufacturing molten iron by using raw coals and fine iron ores in an apparatus for manufacturing molten iron including multi-staged fluidized-bed reduction reactors for reducing the fine ores; and a packed type melter-gasifier for manufacturing molten iron by using the fine reduced irons comprising:

a step of arranging grooves of the left and right press rolls with a suitable gap therebetween to be offset with each other, a surface of the left and right press rolls comprising flat portions and the grooves; and

a step of manufacturing compacted materials with a plate form by charging and pressing mixture of the hot fine reduced irons and calcined additives or only hot fine reduced irons discharged from a final reduction reactor of the fluidized-bed reduction reactors into a gap formed between the left and right press rolls while rotating them along a direction opposing to each other, thereby manufacturing the compacted materials with a plate form.

2. The method of Claim 1, wherein the mixture of the hot fine reduced irons and calcined additives are discharged from the final reduction reactor of the fluidized-bed reduction reactors by charging fine iron ores with additives into the multi-staged fluidized-bed reduction reactors, and

wherein the mixture of the hot fine reduced irons and calcined additives are pressed.

3. The method of Claim 1, wherein an amount of the calcined additives in the mixture of the hot fine reduced irons and calcined additives is in a range from 3wt% to 20wt% of the total amount of the compacted materials.

4. The method of any one of Claim 1 to Claim 3, wherein each flat portion of a surface of the left and right press rolls is formed to have a length of a range from 1mm to 5mm along a direction parallel to a rotating direction of the press rolls, and

wherein a depth of the groove of the surface of the press roll is in a range from 3mm to 15mm and a distance between the grooves is in a range from 20mm to 50mm.

5. The method of Claim 4, wherein the offset distance between the left and right press rolls is in a range from 50% to 70% of the distance between the grooves.

6. The method of any one of Claim 1 to Claim 3, wherein a density of the compacted materials is set to be in a range from 3.5ton/m^3 to 4.2ton/m^3 and thickness thereof is set to be in a range from 3mm to 30mm under a roll pressing condition.

7. The method of Claim 4, wherein a density of the compacted materials is set to be in a range from 3.5ton/m^3 to 4.2ton/m^3 and thickness thereof is set to be in a range from 3mm to 30mm under a roll pressing condition.

8. The method of Claim 5, wherein a density of the compacted materials is set to be in a range from 3.5ton/m^3 to 4.2ton/m^3 and thickness thereof is set to be in a range from 3mm to 30mm under a roll pressing condition.

9. The method of any one of Claim 1 to Claim 3, wherein a pressing temperature is set to be in a range from 400¡æ to 800¡æ and a pressing pressure is set to be in a range from 140bar to 250bar during the roll pressing.

10. The method of Claim 4, wherein a pressing temperature is set to be in a range from 400¡æ to 800¡æ and a pressing pressure is set to be in a range from 140bar to 250bar during the roll pressing.

11. The method of any one of Claim 5, 7 and 8, wherein a pressing temperature is set to be in a range from 400¡æ to 800¡æ and a pressing pressure is set to be in a range from 140bar to 250bar during the roll pressing.

12. The method of Claim 6, wherein a pressing temperature is set to be in a range from 400¡æ to 800¡æ and a pressing pressure is set to be in a range from 140bar to 250bar during the roll pressing.

13. A method for manufacturing compacted materials for being used in a melter-gasifier in a process for manufacturing molten iron by using raw coals and fine iron ores in an apparatus for manufacturing molten iron including multi-staged fluidized-bed reduction reactors for reducing the fine ores; and a packed type melter-gasifier for manufacturing molten iron by using the fine reduced irons comprising:

a step of arranging grooves of the left and right press rolls with a suitable gap therebetween to be offset with each other, a surface of the left and right press rolls comprising flat portions and the grooves;

a step of manufacturing compacted materials with a plate form by charging and pressing mixture of the hot fine reduced irons and calcined additives or only hot fine reduced irons discharged from a final reduction reactor of the fluidized-bed reduction reactors into a gap formed between the left and right press rolls while rotating them along a direction opposing to each other, thereby manufacturing the compacted materials with a plate form; and

a step of crushing the manufactured compacted materials in order to have a shape and mechanical property which are suitable for being charged into the melter-gasifier.

14. The method of Claim 13, wherein the mixture of the hot fine reduced irons and calcined additives are discharged from the final reduction reactor of the fluidized-bed reduction reactors by charging fine iron ores with additives into the multi-staged fluidized-bed reduction reactors, and

wherein the mixture of the hot fine reduced irons and calcined additives are pressed.

15. The method of Claim 14, wherein an amount of the calcined additives in the mixture of the hot fine reduced irons and calcined additives is in a range from 3wt% to 20wt% of the total amount of the compacted materials.

16. The method of any one of Claim 13 to Claim 15, wherein each flat portion of a surface of the left and right press rolls is formed to have a length of a range from 1mm to 5mm along a direction parallel to a rotating direction of the press rolls, and

wherein the a depth of the groove of the surface of the press roll is in a range from 3mm to 15mm and a distance between the grooves is in a range from 20mm to 50mm.

17. The method of Claim 16, wherein the offset distance between the left and right press rolls is in a range from 50% to 70% of the distance between the grooves.

18. The method of any one of Claim 13 to Claim 15, wherein a density of the compacted materials is set to be in a range from 3.5ton/m^3 to 4.2ton/m^3 and thickness thereof is set to be in a range from 3mm to 30mm under a roll pressing condition.

19. The method of Claim 16, wherein a density of the compacted materials is set to

be in a range from 3.5ton/m^3 to 4.2ton/m^3 and thickness thereof is set to be in a range from 3mm to 30mm under a roll pressing condition.

20. The method of Claim 17, wherein a density of the compacted materials is set to be in a range from 3.5ton/m^3 to 4.2ton/m^3 and thickness thereof is set to be in a range from 3mm to 30mm under a roll pressing condition.

21. The method of any one of Claim 13 to Claim 15, wherein a pressing temperature is set to be in a range from 400¡æ to 800¡æ and a pressing pressure is set to be in a range from 140bar to 250bar during the roll pressing.

22. The method of Claim 16, wherein a pressing temperature is set to be in a range from 400¡æ to 800¡æ and a pressing pressure is set to be in a range from 140bar to 250bar during the roll pressing.

23. The method of any one of Claim 17, 19 and 20, wherein a pressing temperature is set to be in a range from 400¡æ to 800¡æ and a pressing pressure is set to be in a range from 140bar to 250bar during the roll pressing.

24. The method of Claim 18, wherein a pressing temperature is set to be in a range from 400¡æ to 800¡æ and a pressing pressure is set to be in a range from 140bar to 250bar during the roll pressing.

25. The method of any one of Claim 13, 14, 15, 17, 19, 20, 22 and 24, wherein the manufactured compacted materials have an irregular shape with a density of a range from 3.5ton/m^3 to 4.2ton/m^3 and a size not more than 50mm.

26. The method of Claim 16, wherein the manufactured compacted materials have an irregular shape with a density of a range from 3.5ton/m^3 to 4.2ton/m^3 and a size not more than 50mm.

27. The method of Claim 18, wherein the manufactured compacted materials have an irregular shape with a density of a range from 3.5ton/m^3 to 4.2ton/m^3 and a size not more than 50mm.

28. The method of Claim 22, wherein the manufactured compacted materials have

an irregular shape with a density of a range from 3.5ton/m^3 to 4.2ton/m^3 and a size not more than 50mm.

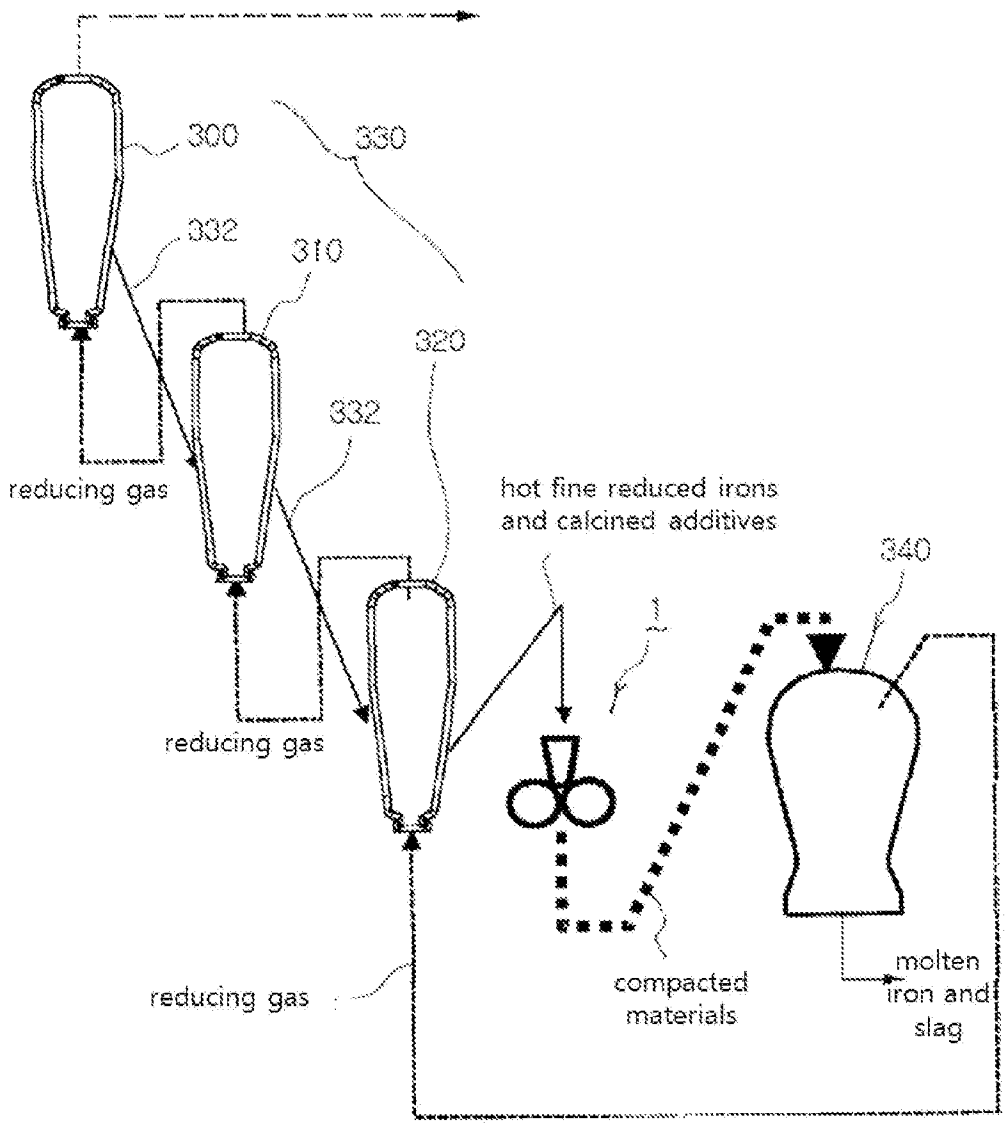
29. The method of Claim 23, wherein the manufactured compacted materials have an irregular shape with a density of a range from 3.5ton/m^3 to 4.2ton/m^3 and a size not more than 50mm.

30. The method of Claim 25, wherein a size distribution of the manufactured compacted materials for being used in the melter-gasifier is not more than 20% with a size of a range from 30mm to 50mm; at a range from 10% to 40% with a size of a range from 30mm to 50mm; at a range from 10% to 40% with a size of a range from 10mm to 20mm; at a range from 5% to 30% with a size of a range from 1mm to 10mm; and at a range not more than 10% with a size of not more than 1mm.

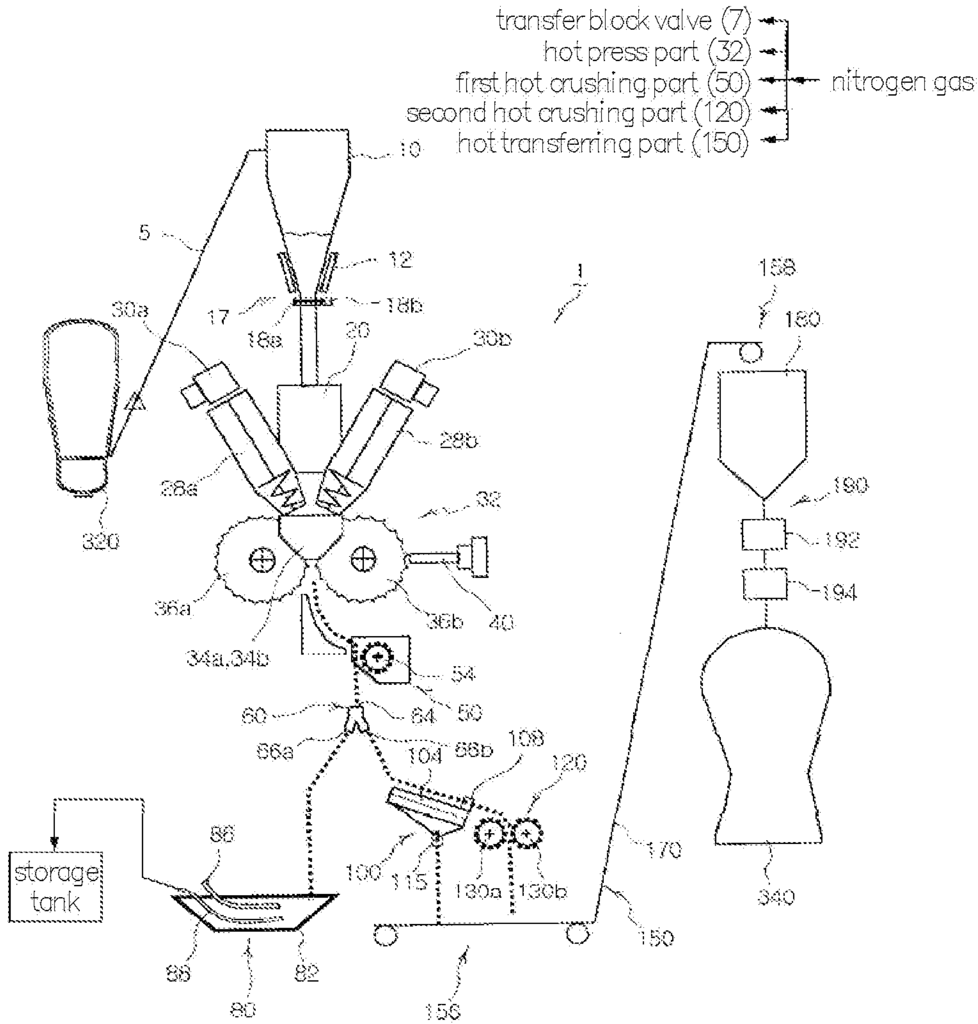
31. The method of any one of Claim 26 to Claim 30, wherein a size distribution of the manufactured compacted materials for being used in the melter-gasifier is not more than 20% with a size of a range from 30mm to 50mm; at a range from 10% to 40% with a size of a range from 30mm to 50mm; at a range from 10% to 40% with a size of a range from 10mm to 20mm; at a range from 5% to 30% with a size of a range from 1mm to 10mm; and at a range not more than 10% with a size of not more than 1mm.

【Drawings】

【FIG. 1】

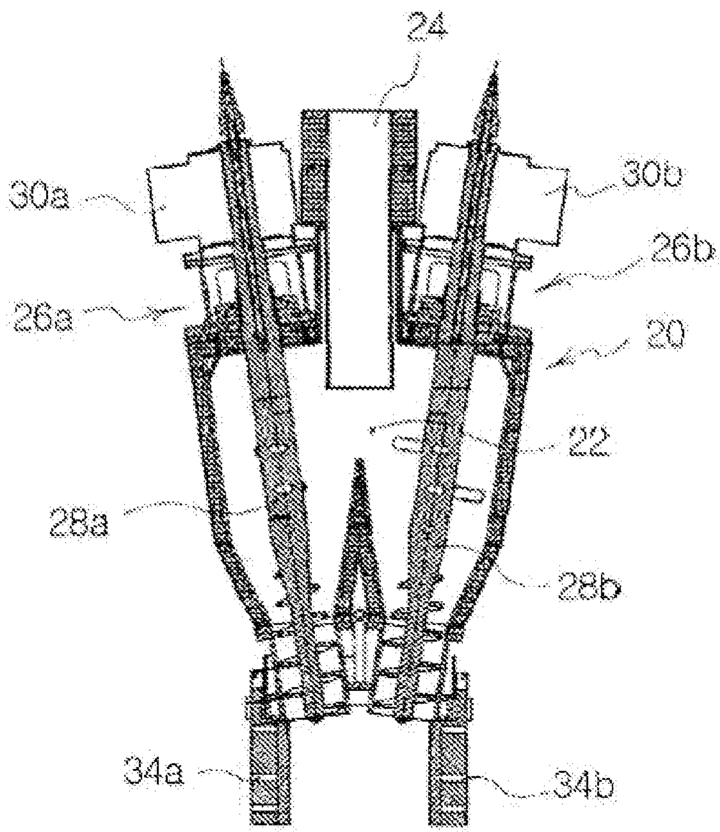


【FIG. 2】

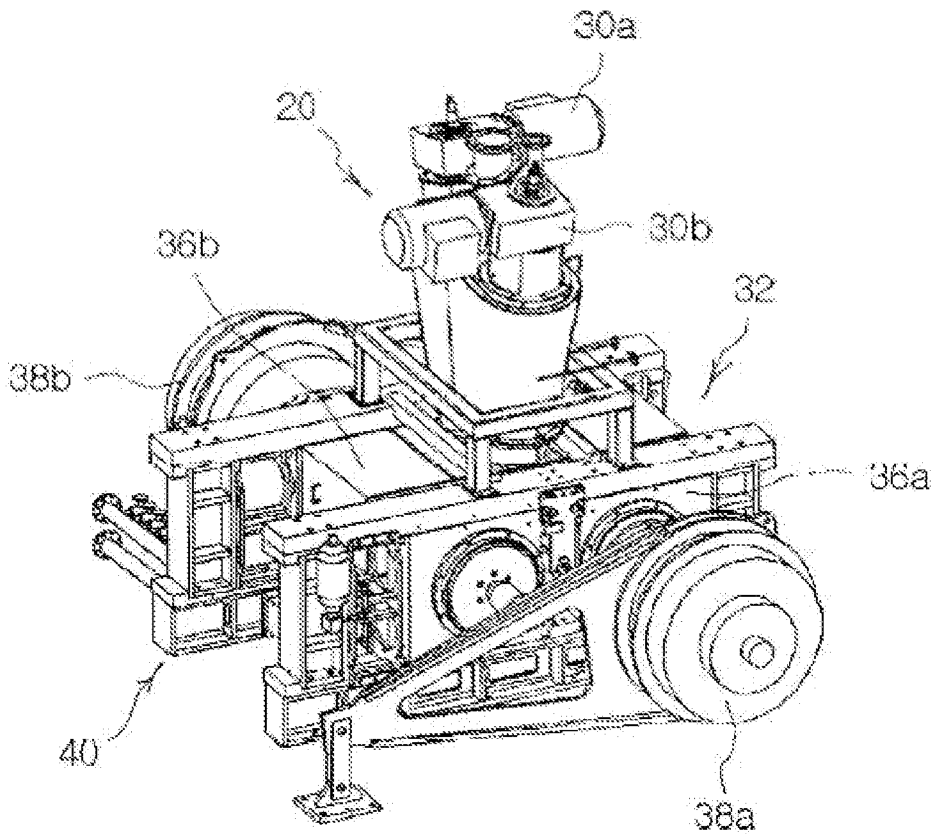


transfer block valve (7)
hot press part (32)
first hot crushing part (50)
second hot crushing part (120)
hot transferring part (150)
nitrogen gas
10
5
12
17
18a
18b
1
158
160
30a
30b
20
28a
28b
32
320
190
192
194
36a
36b
40
34a,34b
54
50
60
64
66a
66b
104
108
120
86
storage tank
100
115
130a
130b
170
340
88
82
80
156
150

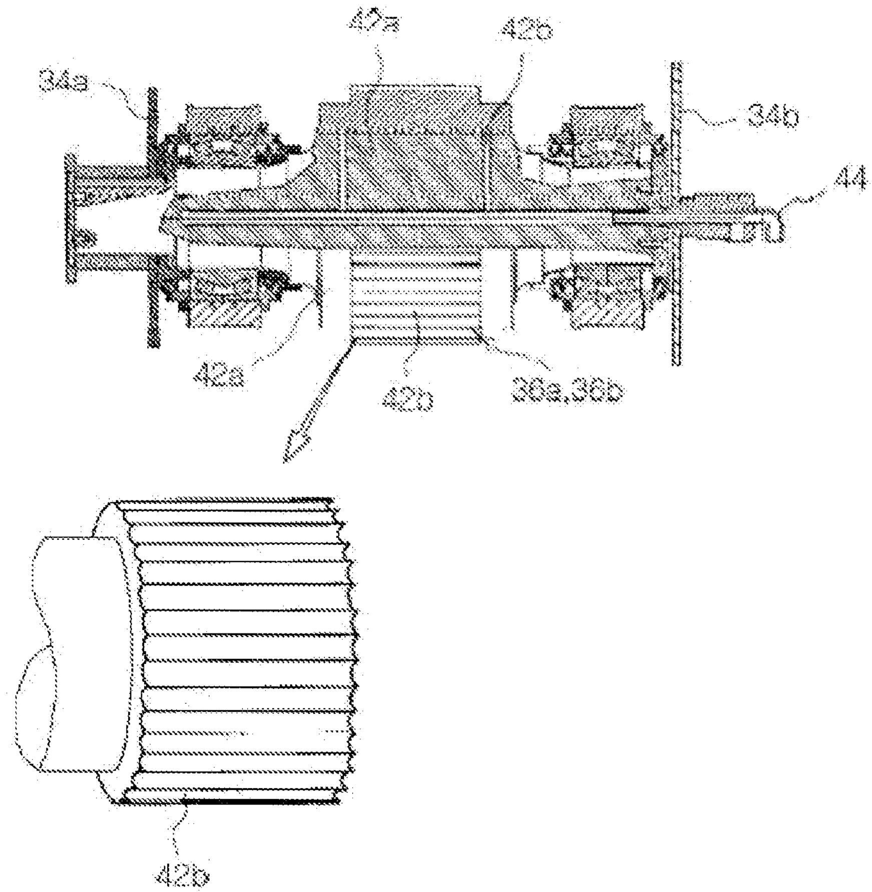
□yFIG. 3□z



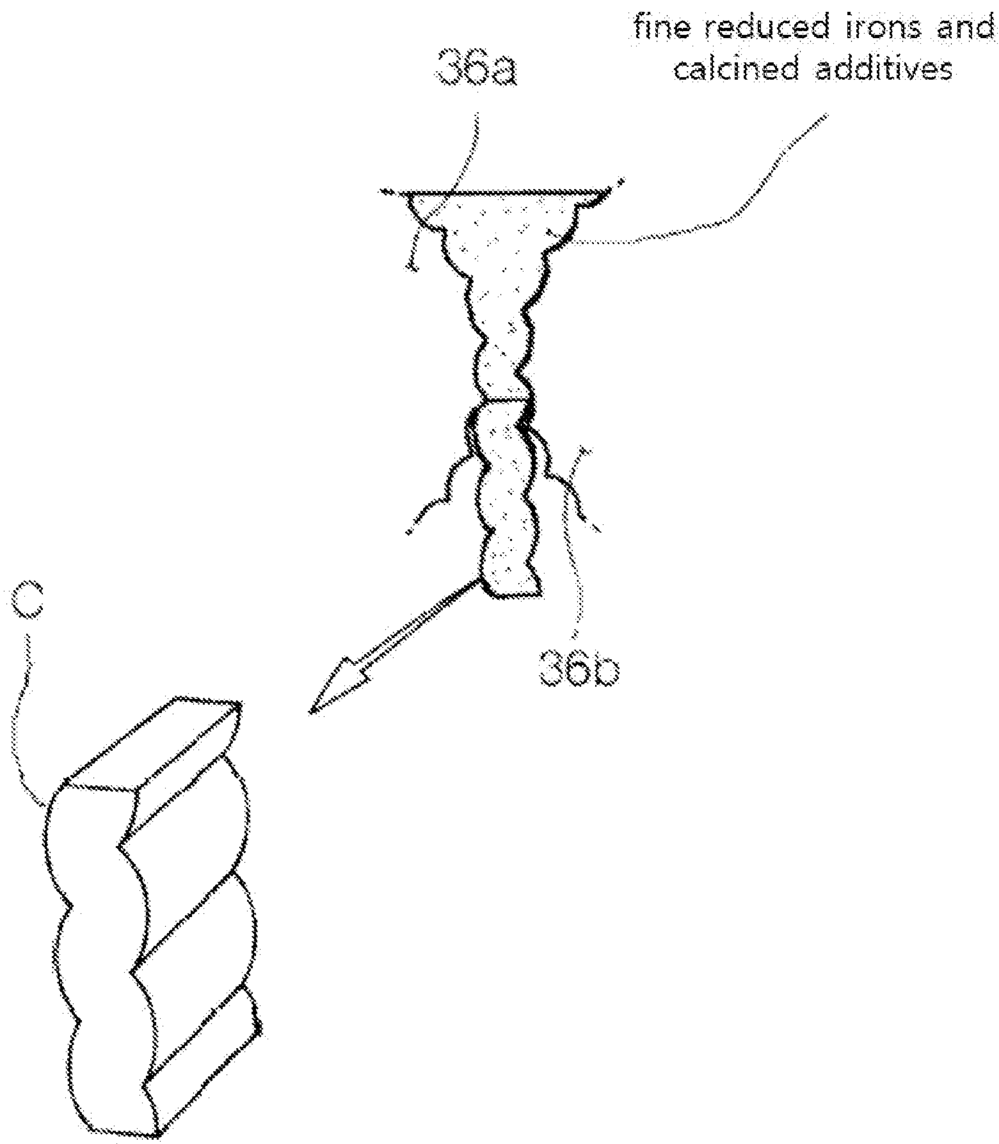
□yFIG. 4a□z



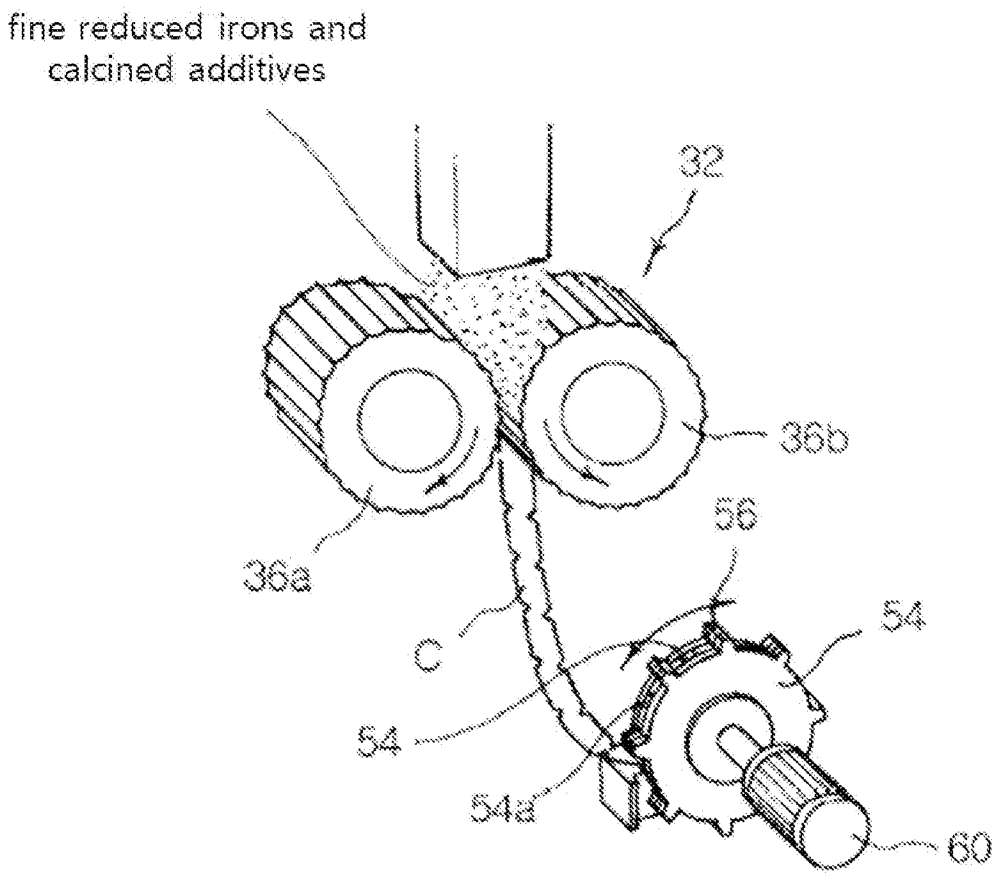
□yFIG. 4b□z



□yFIG. 5□z

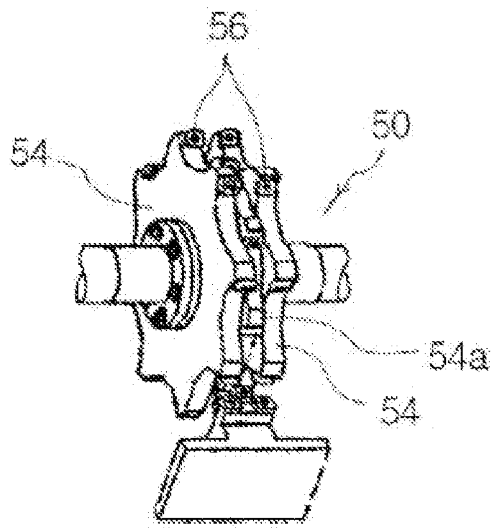


□yFIG. 6□z



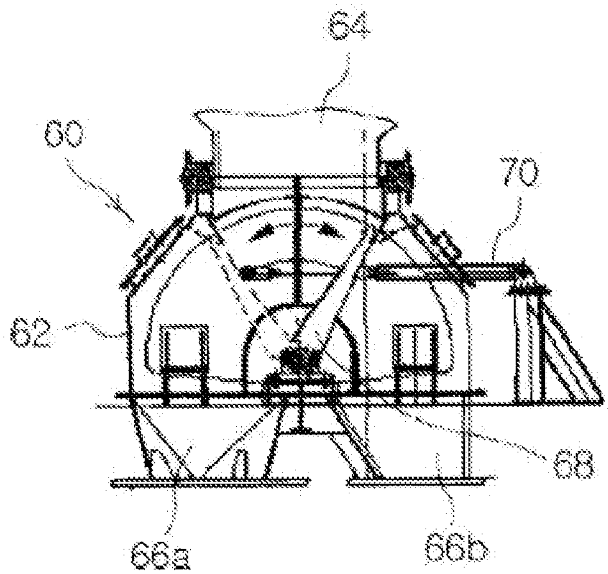
fine reduced irons and calcined additives
32
36b
36a
56
54
C
54
54a
60

□yFIG. 7□z

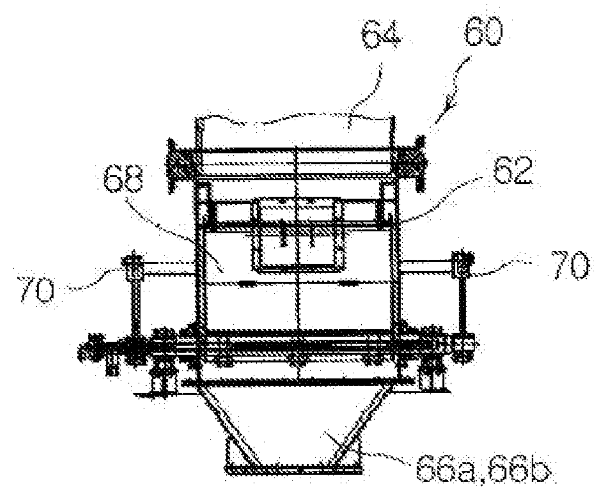


□yFIG. 8□z

(a)

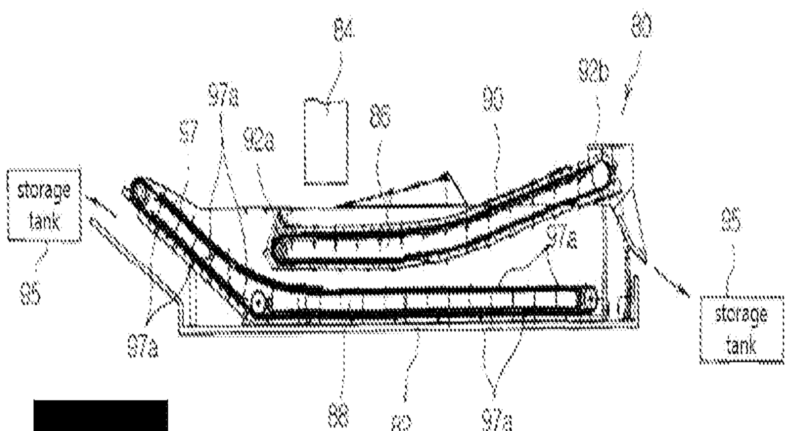


(b)

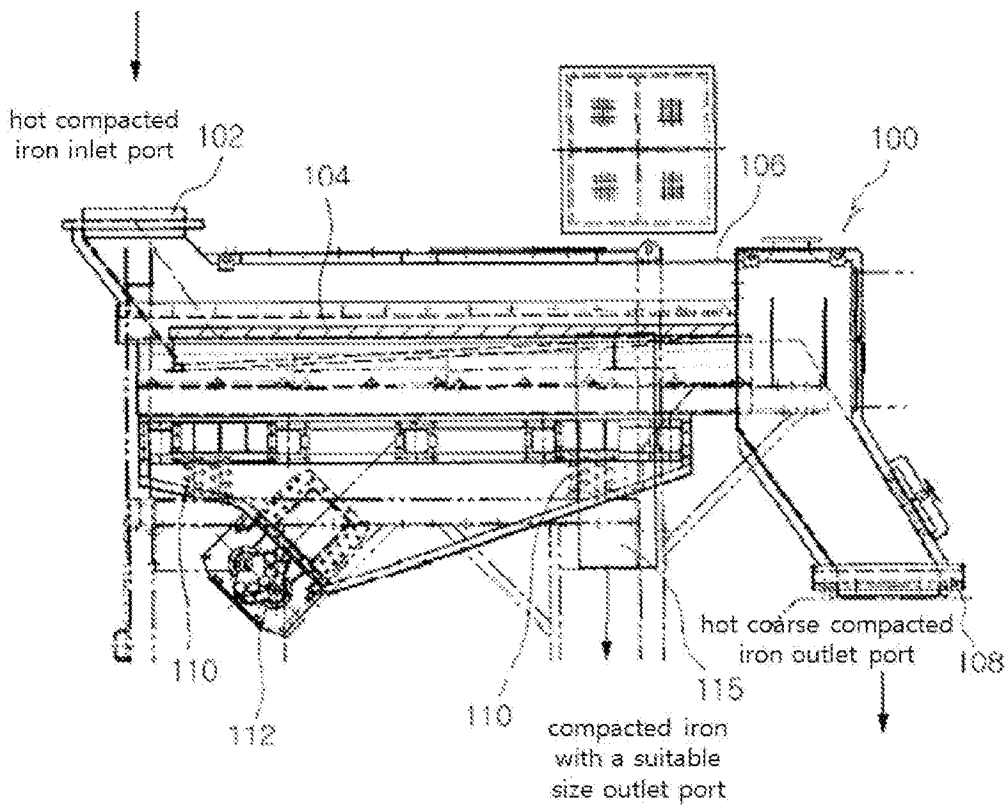


□yFIG. 9□z

[redacted]

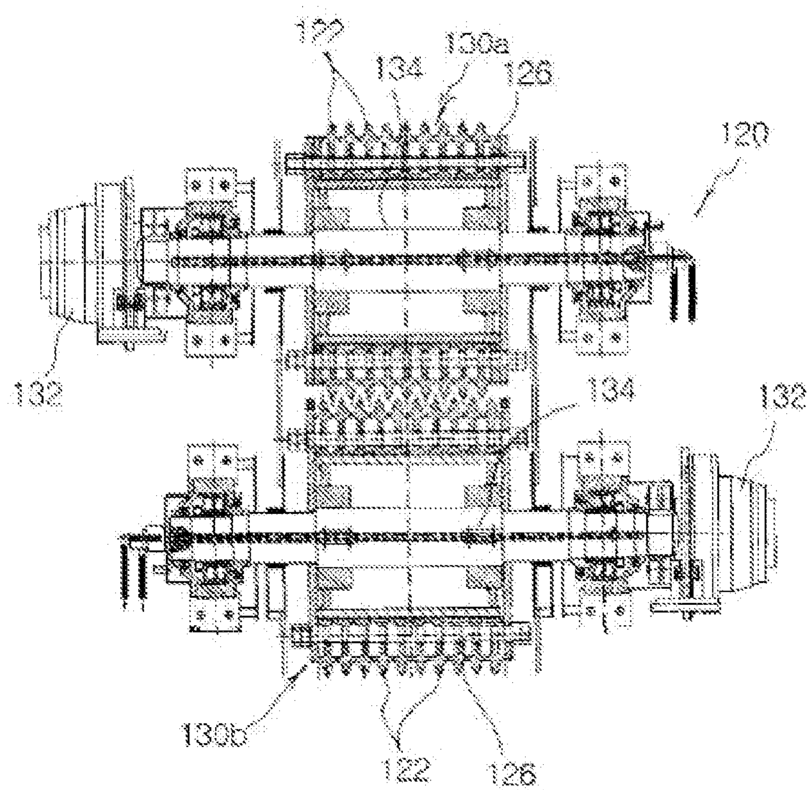


【FIG. 10】

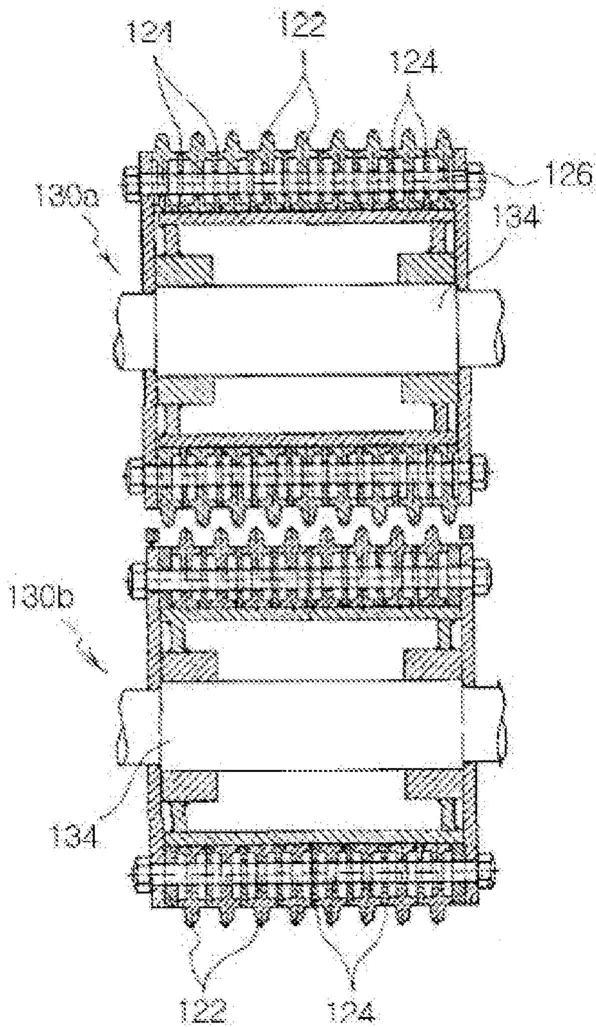


hot compacted
iron inlet port
102
104
106
100
110
112
110
115
108
hot coarse compacted
iron outlet port
compacted iron
with a suitable
size outlet port

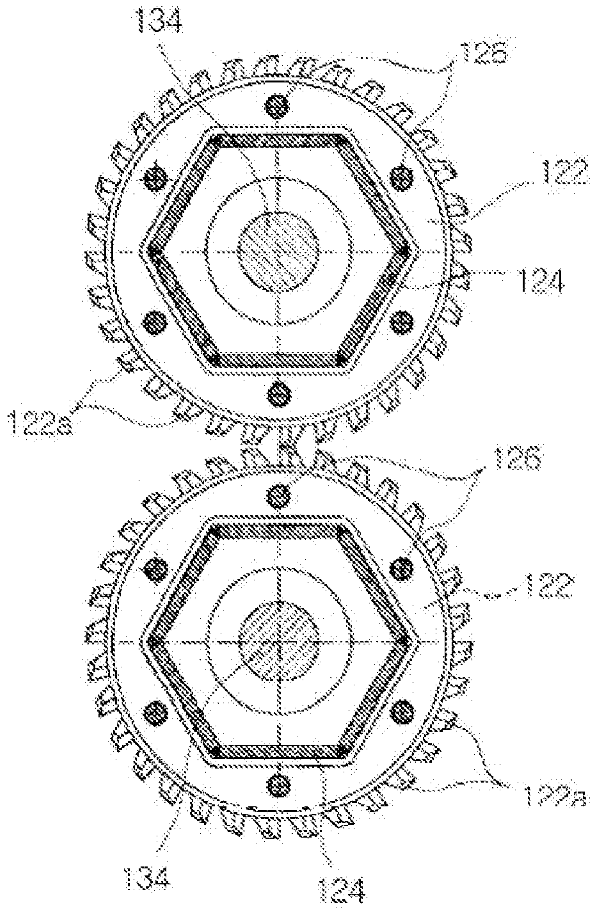
□yFIG. 11□z



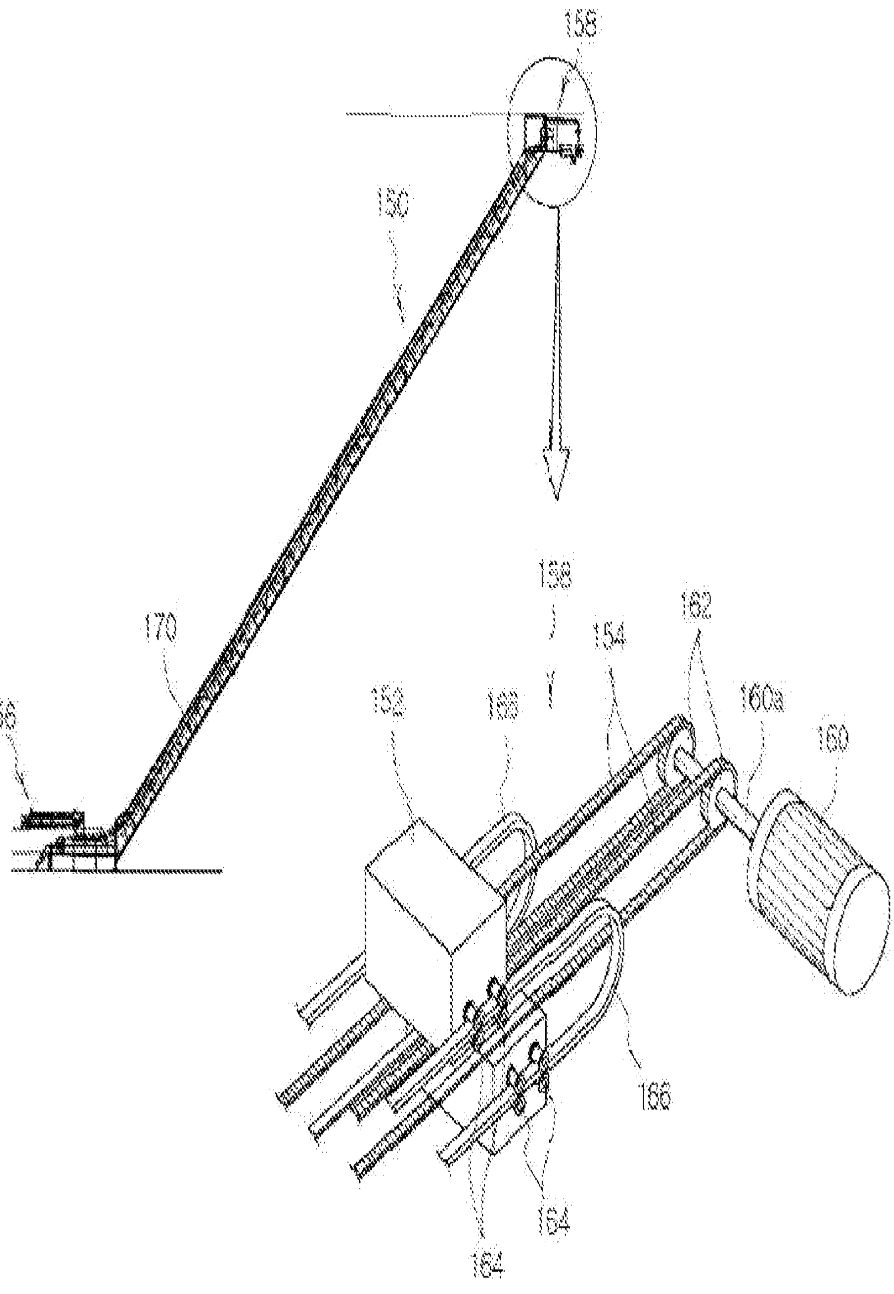
□yFIG. 12□z



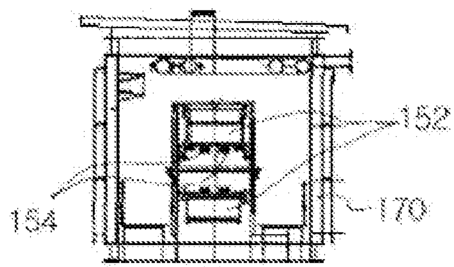
□yFIG. 13□z



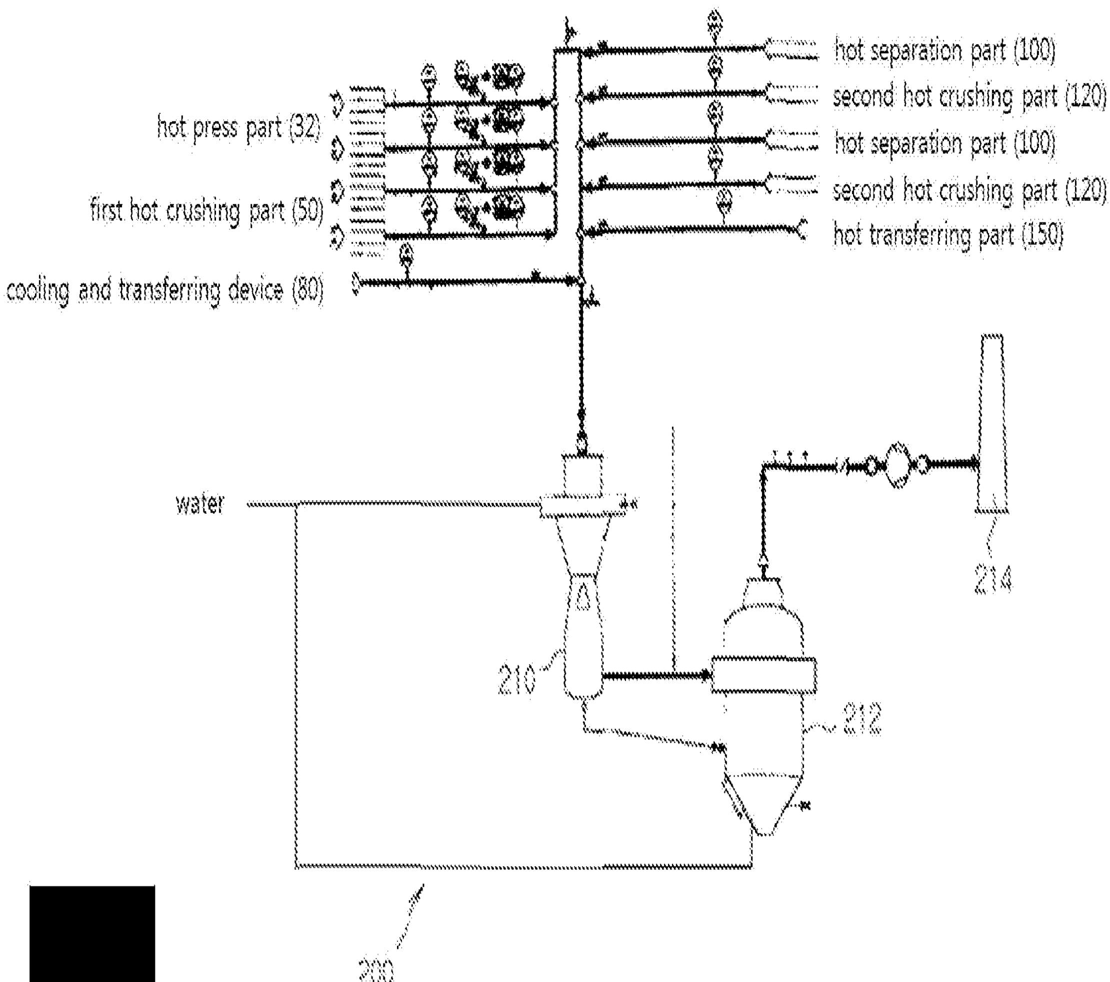
□yFIG. 14a□z



□yFIG. 14b□z

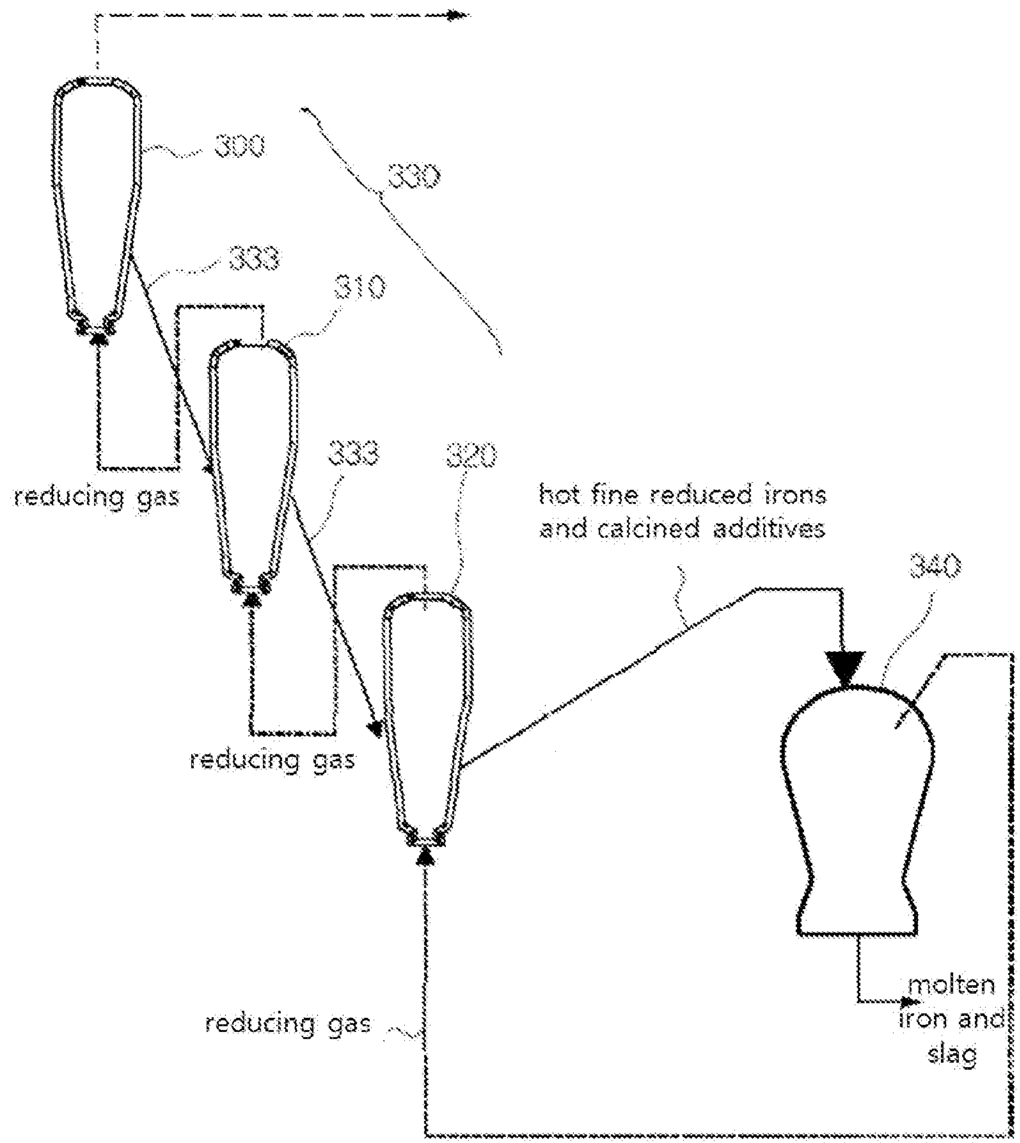


□yFIG. 15□z

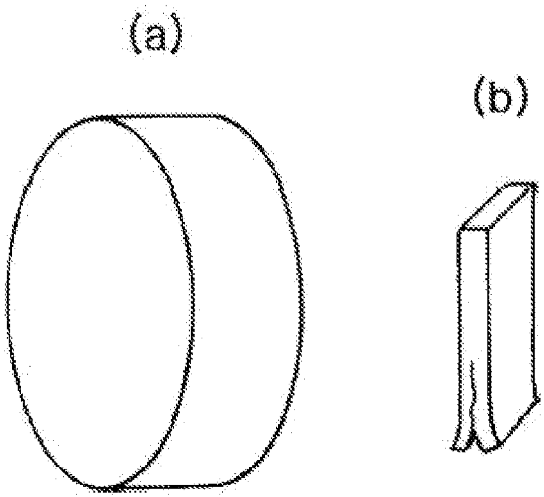


hot separation part (100)
second hot crushing part (120)
hot separation part (100)
second hot crushing part (120)
hot transferring part (150)
hot press part (32)
first hot crushing part (50)
cooling and transferring device (80)
water
214
210
212
200

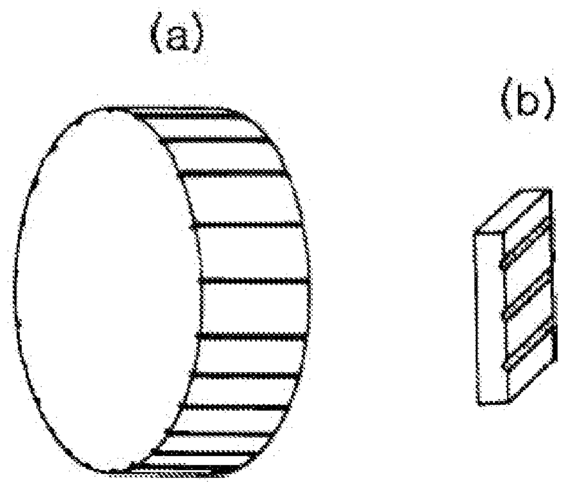
□yFIG. 16□z


300
330
333
310
reducing gas
333
320
hot fine reduced irons
and calcined additives
340
reducing gas
reducing gas
molten
iron and
slag

□yFIG. 17□z



□yFIG. 18□z



□yFIG. 19□z

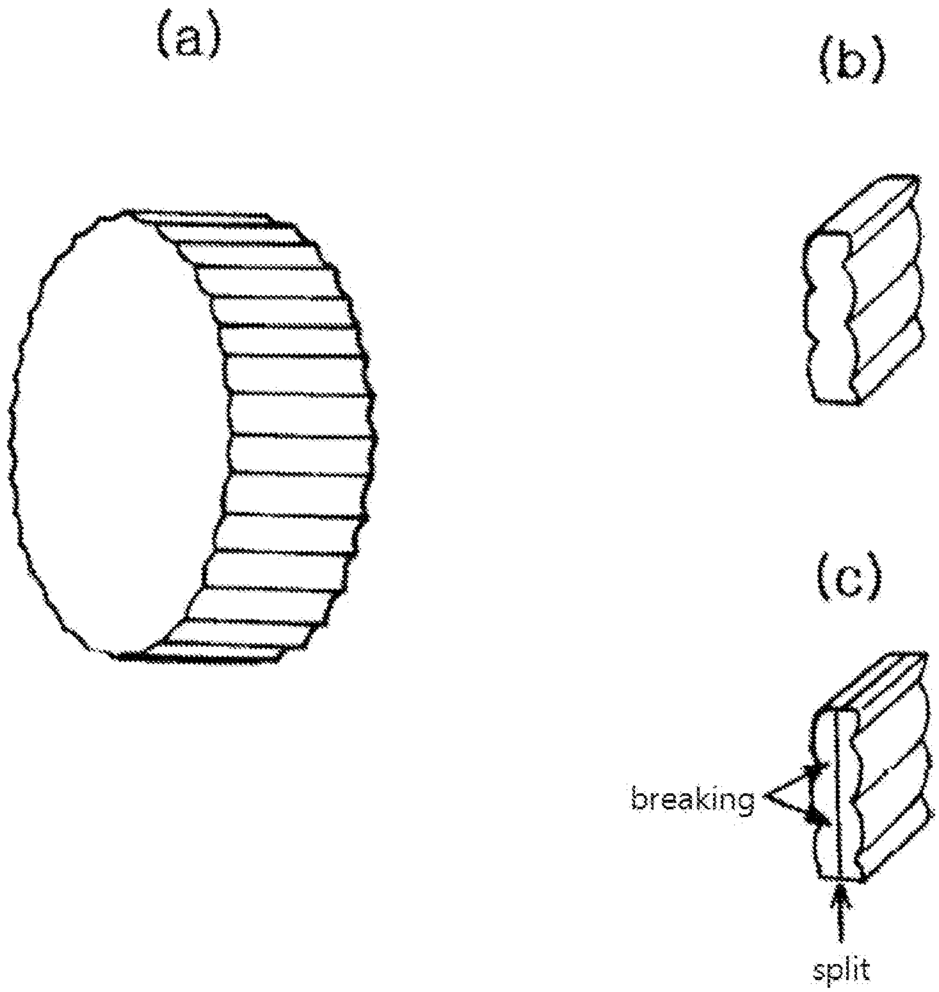


EXHIBIT "B"

I, the undersigned, who have prepared English translation which is attached herewith, hereby declare that the aforementioned translation is true and correct translation of officially certified copy of the Korean Patent Application No. 10-2002-0082120 filed on December 21, 2002.

Translator: ______________

Yong-Kyoo LEE

Date: January 20, 2010

KOREAN INTELLECTUAL PROPERTY OFFICE

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office.

Date of Application: December 21, 2002

Application Number: Patent Application No. 10-2002-0082120

Applicant(s): POSCO

COMMISSIONER

APPLICATION FOR PATENT

10-2002-82120

To the Commissioner of
the Korean Intellectual Property Office

REFERENCE NO:	0006
FILING DATE:	December 21, 2002
IPC:	C22B 1/214
TITLE:	AN APPARATUS FOR HOT COMPACTION OF FINE DRI AND CALCINED ADDITIVES IN NON-COKING COAL AND FINE ORE BASED IRON MAKING PROCESS
APPLICANT:	POSCO
ATTORNEYS:	SON, Won; KIM, Seong-Tae
INVENTOR:	KANG, Chang Oh;
	LEE, Kwang Hee;
	JOO, Sang Hoon; and
	KIM, Sung Gon

Submitted herewith is an application identified above pursuant to Article 42 of the Patent Act.

□yAbstract□z

The present invention relates to an apparatus for manufacturing hot compacted materials with a shape and a size suitable for being charged into the packed type melter-gasifier in a process for manufacturing molten iron using raw coals and fine iron ores by multi-staged fluidized-bed reduction reactors and a packed type melter-gasifier.

The present invention provides an apparatus for hot compacting fine reduced irons and calcined additives includes a hot compacting part that is arranged between a final reduction reactor of the fluidized-bed reduction reactor and the melter-gasifier and pressing hot fine reduced irons and calcined additives discharged from the final reduction reactor into compacted materials with a plate; and a hot crushing part that crushes the compacted materials into compacted materials made of coarse fine reduced irons and calcined additives with a shape and mechanical property suitable for being charged into the melter-gasifier.

According to the present invention, operating convenience and efficiency can be improved by providing an apparatus for hot compacting fine reduced irons in a process for manufacturing molten iron using raw coals and fine iron ores. In addition, installation operating flexibility is secured to improve operating rate of the installation, and then obtains an effect that efficiency and productivity of a process for manufacturing molten iron can be improved during manufacturing of the compacted materials.

□yRepresentative Drawing□z

FIG. 2

□yKeyword□z

fluidized-bed reduction reactor, melter-gasifier, fine reduced iron, calcined additive, apparatus for hot compacting

□ySpecification□z

□yTitle□z

An apparatus for hot compaction of fine dried and calcined additives in non-coking coal and fine ore based iron making process

□yBrief description of the drawings□z

FIG. 1 is a schematic view of a process for manufacturing molten iron including an apparatus for hot compacting fine reduced irons and calcined additives according to the present invention; a fluidized-bed reduction reactor for reducing fine iron ores; and a melter-gasifier for producing molten iron and slag by charging raw coals and reduced irons thereinto.

FIG. 2 is a detailed view of an entire process of the apparatus for manufacturing hot compacted materials including a hot storage installation for storing fine reduced irons and calcined additives; an apparatus for charging fine reduced irons; and an apparatus for manufacturing hot compacted materials including crusher.

FIG. 3 is a detailed sectional view of a charging bin provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention.

FIG. 4 is a structural view of a hot press part provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention wherein a) shows an outer perspective view of the hot press part and b) shows a detailed sectional view of the press roll.

FIG. 5 is a detailed view of a compacted shape of the fine reduced irons and calcined additives molded by a roll tyre of the press roll provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention.

FIG. 6 is a hot press part and a hot crushing part provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention.

FIG. 7 is a perspective view of a crushing roll included in a hot crushing part provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention.

FIG. 8 is a detailed view of a hot branching part in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention wherein a) shows a left sectional view and b) shows a right sectional view.

FIG. 9 is a detailed sectional view of an apparatus for cooling and transferring

compacted materials provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention.

FIG. 10 is a longitudinal sectional view of a hot separation part provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention.

FIG. 11 is a horizontal sectional view of a second crushing part provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention.

FIG. 12 is a horizontal sectional view of a structure of a crushing roll of the second crushing part provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention.

FIG. 13 is a longitudinal sectional view of a structure of a crushing roll of the second crushing part provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention.

FIG. 14 is a detailed view of a hot transferring part provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention wherein a) is a side view and b) is a detailed sectional view.

FIG. 15 is a systematic view of wet dust collector provided in the apparatus for manufacturing hot compacted materials from the fine reduced irons and calcined additives according to the present invention

FIG. 16 is a schematic view of a process for manufacturing molten iron including a fluidized-bed reduction reactor for reducing fine iron ores according to a conventional art and a melter-gasifier for manufacturing molten iron and slag by charging raw coals and reduced irons thereinto.

FIG. 17 is a table showing a grain size and mechanical property of the compacted materials made of fine reduced irons and calcined additives obtained according to the present invention.

* explanation of reference numerals of the main part shown in the drawings *

1. apparatus for manufacturing hot compacted materials
5. pressured transferring pipe

10. hot storage bin
12. apparatus for controlling level
17. transfer/block valve
18a. plate
18b. hydraulic actuator
20. charging bin
26a, 26b. charging device
28a, 28b. charging member
30a, 30b. electric motor
32. hot pressing part
36a, 36b. press roll
38a, 38b. hydraulic motor
40. hydraulic pressing part
42a. body shaft
42b. roll tyre
44. cooling water
50. hot crushing part
54. crushing plate
54a. spacer ring
56. protrusion
60. hot branching part
62. hollow type housing
68. separation plate
70. hydraulic cylinder
80. cooling and transferring device
82. water container
86, 88. pan conveyor
90. belt
95. storage tank
100. hot separation part
102. inlet port
106. casing
110. spring
112. vibrator
115. fine particle outlet port
120. second hot crushing part

122. disc type blade
124. spacer ring
126. tie bolt
130a, 130b. cylindrical crushing roll
134. central axis
150. hot transferring part
152. bucket
154. chain
156. compacted materials loading part
158. compacted materials unloading part
160. driving motor
170. tunnel
180. hot storage part
190. charging device
200. wet dust collector
210. wet scrubber
212. moisture remover
300. pre-heater
310. pre-reduction reactor
320. final reduction reactor
330. fluidized-bed reduction reactor
340. melter-gasifier
C. compacted materials

□yDetailed description of the invention□z

□yObject of the invention□z

□yTechnical field to which the invention belongs and background of the technical field□z

<54> The present invention relates to an apparatus for manufacturing compacted materials of fine reduced irons using raw coals and fine reduced irons in a process for manufacturing molten iron, more specifically to an apparatus for manufacturing hit compacted irons with a shape and a size suitable for being charged into the packed type melter-gasifier by directly hot compacting fine reduced irons and calcined additives discharged from the fluidized-bed reduction reactor and connected to the fluidized-bed reduction reactor and the packed type melter-gasifier in a process for manufacturing molten iron using raw coals and fine reduced irons by the fluidized-

bed reduction reactor and the melter-gasifier.

<55>¡¦<70> omitted

□yTechnical object of the invention□z

<71> In order to solve the above problems, the present invention hot compacts fine reduced irons and calcined additives and supplies compacted materials with a strength and a size distribution suitable for melting and slagging and is consistently connected to the fluidized-bed reduction reactor and the melter-gasifier. Therefore, the present invention is objected to provide an apparatus for hot compacting fine reduced irons and calcined additives to improve operating convenience and efficiency in a process for manufacturing molten iron, operating rate of the installation by securing installation operating flexibility, and operating efficiency and productivity.

□yConstitution of the invention□z

<72> In order to carry out the object above, the present invention,

<73> In a process for manufacturing molten iron by using raw coals and fine iron ores with multi-staged fluidized-bed reduction reactors and a packed type melter-gasifier,

<74> a hot compacting part that is arranged between a final reduction reactor of the fluidized-bed reduction reactor and the melter-gasifier and pressing hot fine reduced irons and calcined additives discharged from the final reduction reactor into compacted materials with a plate

<75> An apparatus for manufacturing hot compacted materials of fine reduced irons and calcined additives in a process for manufacturing molten iron using raw coals and fine iron ores is characterized to include a hot crushing part, located at a rear side of the hot compacting part, crushes the compacted materials into compacted materials made of coarse fine reduced irons and calcined additives with a shape and mechanical property suitable for being charged into the melter-gasifier.

<76> The present invention will be explained in detail with reference to drawings.

<77> As shown in FIG. 1, the apparatus for manufacturing hot compacting fine reduced irons and calcined additives 1 according to the present invention is provided to be connected to the final reduction reactor 320 and a melter-gasifier 340 respectively, therebetween.

<78>...<83> omitted

<84> As shown in FIG. 3, in the hot charging devices 26a and 26b, two sets of spiral type charging members 28a and 28b are slanted at both sides of the charging bin 20 to a direction to be perpendicular direction and arranged toward a lower end outlet port of the charging bin 20. The electric motors 30a and 30b are provided to rotate and drive the charging members 28a and 28b at an upper end of the charging bin 20.

<85> The spiral type charging members 28a and 28b are installed above the left and right press rolls 36a and 36b, which will be explained below, and make a charging amount of the fine reduced irons be the same as that of the calcined additives. The spiral type charging members 28a and 28b is made of materials preventing from not being worn out in a maximum manner at a hot state.

<86> omitted

<87> Therefore, A hot press part 32, which presses the fine reduced irons and calcined additives into a plate form, is connected to the lower end of the charging bin 20.

<88> As shown in FIG. 4, the hot press part 32 includes a pair of rotating press rolls 36a and 36b and a leak preventing parts 34a and 34b for preventing hot direct reduced irons from being leaked toward side thereof when the press rolls 36a and 36b rotate along a direction opposing to each other.

<89>...<95> omitted

<96> A hot crushing part 50, which is located at a lower side of the hot press part 32 to be successively connected thereto, separates and crushes the compacted materials Compacted materials made of the fine reduced irons and calcined additives to have a size suitable for being charged into the melter-gasifier 340.

<97> As shown in FIG. 6, the hot crushing part 50 is a device for firstly separating and crushing the compacted materials C made of the fine reduced irons and calcined additives pressed by the hot press part 32 as a size suitable for being charged into the melter-gasifier 340.

<98>...<111> omitted

<112> A hot separation part 100 is provided to successively be connected to a discharging outlet port 66b of the hot branching part 60 and separates grains with a large size included in the compacted materials C made of firstly hot crushed fine reduced irons and calcined additives.

<113> The hot separation part 100 is connected to the hot crushing part 7 and separates compacted materials C made of the fine reduced irons and calcined additives with a size of not less than 30mm after the compacted materials C are crushed. The hot separation part 100 can separate the compacted materials C at a maximum rate of 120ton/h. As shown in FIG. 10, the hot separation part 100 separates a grain with a approximate size of not less than 30mm by vibrating the compacted materials C made of the fine reduced irons and calcined additives charged through an inlet port 102 of the upper portion. The inlet port 102 is formed at an upper portion of a casing 106 including a slanted screen 104 and a large grain discharging port 108 is formed at an opposing side of the inlet port 102.

<114> omitted

<115> Therefore, such hot separation part 100 discharges the compacted materials C with a size of not less than 30mm through the large grain discharging port 108 and discharges the rest compacted materials C with a small size through the small grain discharging port 115. In addition, a second hot crushing part 120, which will be explained below, is arranged under the large grain discharging port 108. A hot transferring part 150 is connected to a lower portion of the small grain discharging port 115 in order to transfer the crushed hot compacted materials C made of the fine reduced irons and calcined additives to the melter-gasifier 340.

<116> As entirely shown in FIG. 11, the second hot crushing part 120, which is connected to the large grain discharging port 108, is successively connected to the hot separation part 100. The second hot crushing part 120 separates and crushes the separated compacted materials C made of fine reduced irons and calcined additives with a large grain size to be suitable for being charged into the melter-gasifier 340.

<117>...<122> omitted

<123> The second hot crushing part 100, which is connected to the large grain discharging outlet 108 of the hot separation part 100, crushes compacted materials C made of the fine reduced irons and calcined additives with a size over 30mm suitable for being charged into the melter-gasifier 340. The second hot crushing part 100 can crush the compacted materials C at a maximum rate of 60ton/h. It is possible to variably control a rotating times and a gap between the impact blades 122 in order to minimize the amount of the fine particles generated during crushing of compacted materials C made of the fine reduced irons and calcined additives.

<124>…<129> omitted

<130> Meanwhile, when hot compacted materials C made of fine reduced irons and calcined additives contact with atmosphere in the apparatus for manufacturing compacted materials 1 for realizing the above present invention, heat is generated to be fired by re-oxidation of the hot compacted materials which reacts with oxygen. Therefore, it is necessary to make inert atmosphere.

<131> Therefore, a nitrogen injection line (not shown) is installed in each of the devices in order to prevent the compacted materials C from being oxidized and operation is carried out under a state of reducing concentration of oxygen. Therefore, natural firing of the compacted materials C is prevented.

<132> As an example, nitrogen injection lines can be installed at transfer/blocking valve 17, hot press part 32, hot crushing part 50, second hot crushing part 120 and hot transferring part 150. Constitution, function and effect of the nitrogen injection lines

can be easily understood by the skilled art, detailed description thereof is omitted.

<133> In addition, wet dust collector 200 is installed to collect hot dusts generated in a process of transferring, charging, crushing and separating of the compacted materials C made of the fine reduced irons and calcined additives in the apparatus for manufacturing hot compacted materials 1 according to the present invention.

<134> As shown in FIG. 15, dust collectors (not shown) are installed in each of the hot press part 32, a hot crushing part 50, a cooling and transferring device 80, a hot separation part 100, a second hot crushing part 120, a hot transferring part 150 and so on. They are connected to a wet scrubber 210 and a moisture remover 212 through a pipe, thereby discharging residues through a chimney 214 after the dusts are removed.

<134> Constitution, function and effect of the wet dust collector can be easily understood by the skilled art, detailed description thereof is omitted.

<136> The action and effect according to the present invention will be explained in detail.

<137> As shown in FIG. 1, the apparatus for hot compacting fine reduced irons and calcined additives 1 according to the present invention is provided to connect the final reduction reactor 320 and the melter-gasifier 340.

<138> As shown in FIG. 2, the apparatus for hot compacting fine reduced irons and calcined additives 1 according to the present invention transfers fine reduced irons and calcined additives discharged from the final reduction reactor 320 through a pressurized pipe 5 and then stores in the hot storage bin 10. The hot fine reduced irons and calcined additives with a temperature of not less than 700¡æ and about 2ton/m^3 of a volume specific gravity discharged therefrom.

<139>¡¦<141> omitted

<142> The compacted material C is pressed into a plate form with a thickness of a range from 3mm to 20mm, a specific gravity of a range from 3.5 to 4.2 ton/m^3, and a dust generating rate of less than 5%.

<143> Since the toll tyre 42b formed on a surface of the press rolls 36a and 36b of the hot press part 32 is formed to have a curved surface and the linear grooves thereof are formed to be offset with each other in the above process, a problem of cracks generated during manufacturing of compacted materials with a plate form having a thickness not less than 8mm by pressing general fine reduced irons and calcined additives is not happened.

<144> In addition, the compacted materials C with a plate form made of fine reduced irons and calcined additives are transferred down toward the hot crushing part 50 located at a lower part thereof through the hot press part 32.

<145>…<146> omitted

<147> A density of the compacted material C made of fine reduced irons and calcined additives manufactured by the hot press part 50 is in a range from 3.5ton/m^3 to 4.2ton/m^3 and a grain size of the compacted material with an irregular shape is not more than 30mm after being crushed.

<148> Meanwhile, if the rotating times are increased in the middle of crushing the compacted materials like above, generating amount of dusts are increased. If the rotating times are reduced, generating amount of fine reduced irons and calcined additives with a size of more than 30mm are increased during a first crushing of the compacted materials. Therefore, generating amount and size of the dusts are controlled by the hot separation part 100 and the second hot crushing part 120 provided afterward.

<149>, <150> omitted

<151> The hot separation part 100 separates a grain with a size of not less than 30mm. The grain with a size of not less than about 30mm is discharged through a large grain discharging outlet port 108 located at an opposite side of the inlet port 102 while grain with a size of not more than 30mm is discharged through a small grain discharging outlet port 115.

<152> In addition, hot compacted materials C with a size of not less than 30mm discharged from the large grain discharging outlet port 108 have gone through a couple of cylindrical crushing rolls 130a and 130b which rotates by the hydraulic motors 132 of the second hot crushing part 120 and then are crushed into a size thereof not more than 30mm, thereby being capable of being charged into the melter-gasifier 340.

<153> In addition, hot compacted materials C for being used in a melter-gasifier crushed with a size of not more than 30mm which have gone through the second hot crushing part 120, and the hot compacted materials for being used in a melter-gasifier crushed with a size of not more than 30mm which have gone through a small grain discharging outlet 115 of the hot separation part 100 are loaded into a plurality of buckets 152 of the hot transferring part 150. The buckets 152 are transferred upward by the plurality of chains driven by an operation of the driving motor 160 provided in the compact materials unloading part 158 located at an upper side.

<154> In addition, as described above, hot compacted materials C made of fine reduced irons and calcined additives crushed with a size of not more than 30mm are loaded into the hot storage bin 180 and then are charged into the melter-gasifier 340 through a plurality of hot pressure equalizing containers 192 and 194 of the charging

device 190.

<155> omitted

<156> The dusts of the compacted materials made of fine reduced irons and calcined additives are collected through dust collectors (not shown) are installed in each of the hot press part 32, a hot crushing part 50, a cooling and transferring device 80, a hot separation part 100, a second hot crushing part 120, a hot transferring part 150 and so on. The dusts pass through a wet scrubber 210 and a moisture remover 212 by using a pipe, thereby residues are discharged through a chimney 214 after the dusts are removed.

<157> Table 1 described in FIG. 17 shows a mechanical property of the fine reduced irons and calcined additives obtained by the present invention and proves that the compacted material has a mechanical property of a shape, density, strength and so on which is suitable as charged materials of the melter-gasifier 340.

<158> These results show that the fine reduced irons and calcined additives discharged from the fluidized-bed reduction reactor 330 can be compacted by the apparatus for hot compacting fine reduced irons and calcined additives 1 according to the present invention and the fine reduced irons and calcined additives can be converted into compacted materials C which is suitable to be charged into the melter-gasifier 340.

□yEffect of the invention□z

<159> As described above, according to the present invention, since the apparatus for hot compacting is consistently connected to the fluidized-bed reduction reactor and the melter-gasifier in a process for manufacturing molten iron by using raw coals and fine iron ores, the hot fine reduced irons and calcined additives discharged from the fluidized-bed reduction reactor can be hot pressed into the compacted materials with a strength and size which are suitable for melting and slagging in the melter-gasifier.

<160> Therefore, the present invention provides an apparatus for hot compacting fine reduced irons and calcined additives in a process for manufacturing molten iron by using raw coals and fine iron ores, thereby improving operating convenience and efficiency in a process for manufacturing molten iron; operating rate of the installation by securing installation operating flexibility during a process of manufacturing compacted materials Compacted materials; and efficiency and productivity of the process for manufacturing molten iron.

□yWhat is claimed is□z

1. An apparatus for hot compacting fine reduced irons and calcined additives in a process for manufacturing molten iron by the multi-staged fluidized-bed reduction reactor 330 and packed type melter-gasifier 340 using raw coals and fine iron ores comprising:

a hot compacting part 32 that is arranged between a final reduction reactor 320 of the fluidized-bed reduction reactor 330 and the melter-gasifier 340, the hot compacting part 32 pressing hot fine reduced irons and calcined additives discharged from the final reduction reactor 320 into compacted materials with a plate form; and

a hot crushing part 50 that is located at a rear side of the hot compacting part 32 and crushes the compacted materials C into compacted materials made of fine reduced irons and calcined additives with a shape and mechanical property suitable for being charged into the melter-gasifier 340.

2. The apparatus of Claim 1, wherein the density of the compacted material C made of fine reduced irons and calcined additives manufactured by the hot press part 50 is in a range from 3.5ton/m^3 to 4.2ton/m^3 and a grain size of the compacted material with an irregular shape is not more than 30mm after being crushed.

3…5. omitted

6. The apparatus of Claim 5, wherein a sheet of compacted materials C with a plate form is made by pressing the fine reduced irons and calcined additives, the sheet of compacted materials C having a thickness of a range from 3mm to 20mm, a specific gravity of a range from 3.5ton/m^3 to 4.2 ton/m^3, and dust generating rate of less than 5%.

7. omitted

8. The apparatus of Claim 7, wherein a hollow chamber 22 is formed in the charging bin 20, and

wherein two sets of spiral charging members 28a and 28b are slanted with respect to a perpendicular direction at both sides of the charging bin 20, arranged toward a lower outlet port of the charging bin 20, and

wherein electric motors 30a and 30b are provided at an upper end of the charging bin 20, and

wherein the electric motors 30a and 30b rotates the charging members 28a and 28b, thereby discharging the fine reduced irons and calcined additives in the charging bin 20 toward the hot press part 32 located thereunder.

9. omitted

10. The apparatus of Claim 5, wherein press rolls 36a and 36b of the hot press part 32 has a roll tyre 42b formed to have a curved shape and

wherein linear grooves are formed to be offset with each other such that a split phenomenon does not occur when the fine reduced irons and calcined additives are pressed to manufacture into a plate type compacted materials with a thickness of not less than 8mm.

11…18. omitted

19. The apparatus of any one of Claims 1, 7 and 11, wherein nitrogen injection lines are installed at transfer/blocking valve 17, hot press part 32, hot crushing part 50, second hot crushing part 120 and hot transferring part 150 and

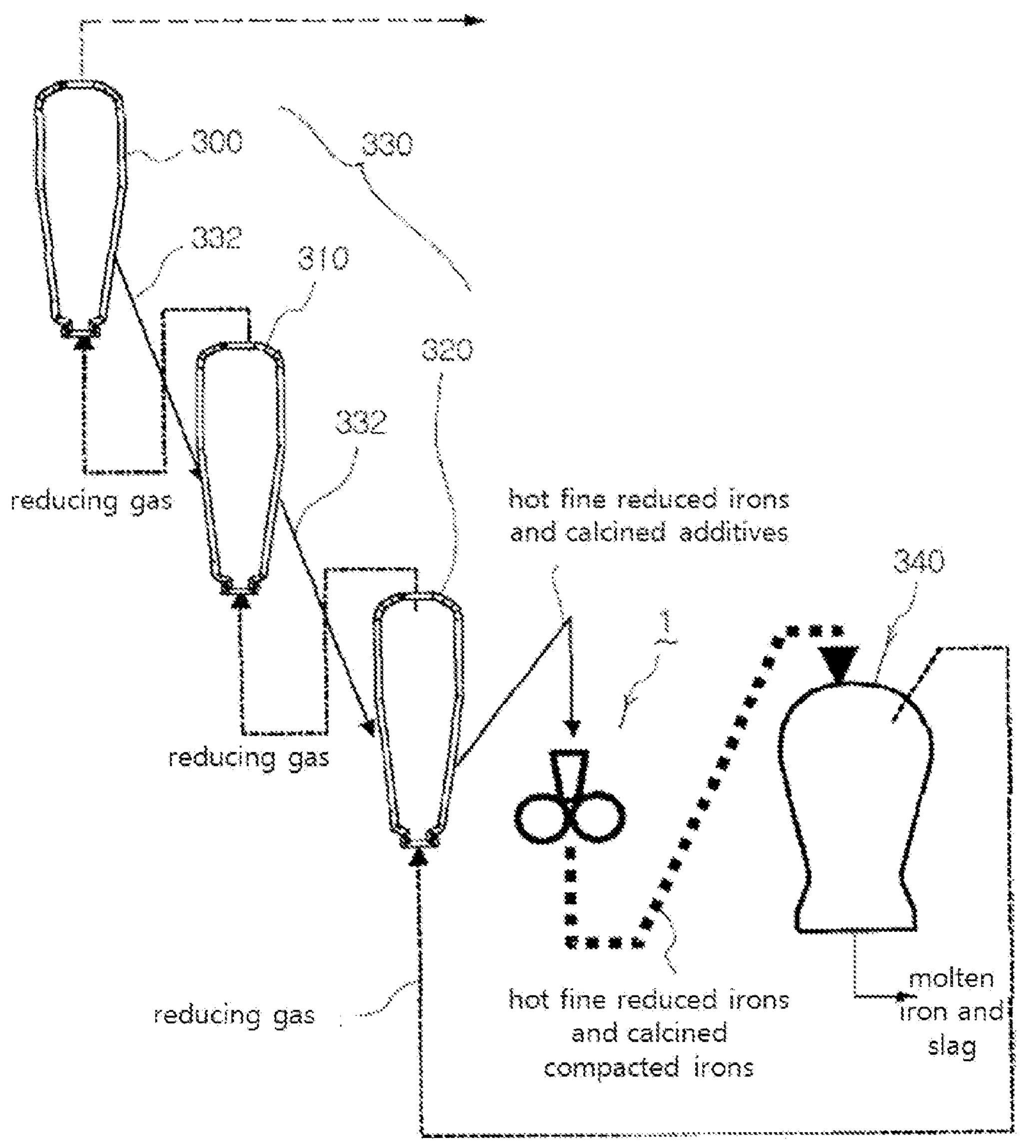
wherein operation is carried out under a state of reducing concentration of oxygen by charging nitrogen through the nitrogen injection lines, thereby natural firing of the compacted materials C is prevented.

20. The apparatus of any one of Claims 1, 7 and 11, wherein dust collecting ports are installed in each of the hot press part 32, a hot crushing part 50, a cooling and transferring device 80, a hot separation part 100, a second hot crushing part 120, a hot transferring part 150 and so on such that hot dusts, which are generated during transferring, charging, crushing and separation of the compacted materials C made of fine reduced irons and calcined additives, are collected and

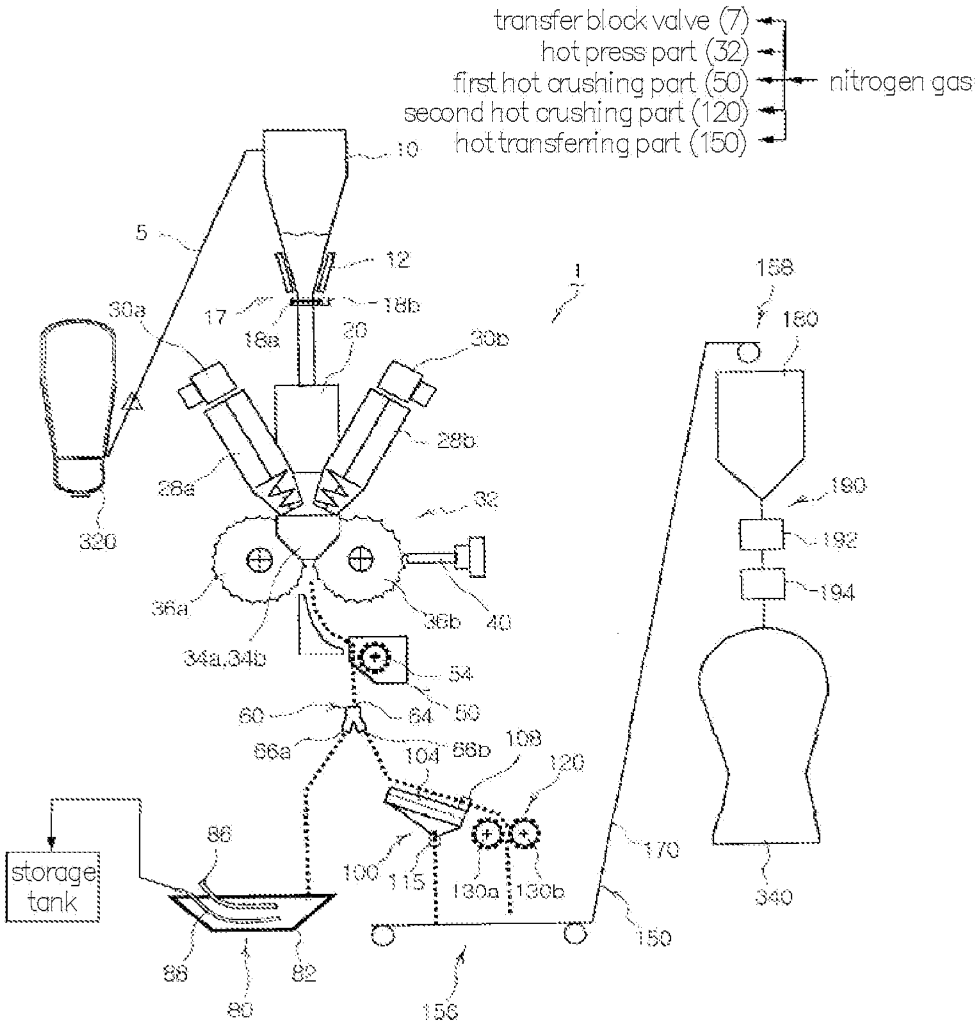
wherein the hot press part 32, a hot crushing part 50, a cooling and transferring device 80, a hot separation part 100, a second hot crushing part 120 and a hot transferring part 150 are connected to a wet scrubber 210 and a moisture remover 212 by using a pipe, thereby residues are discharged outside through a chimney 214 after the dusts are removed.

【Drawings】

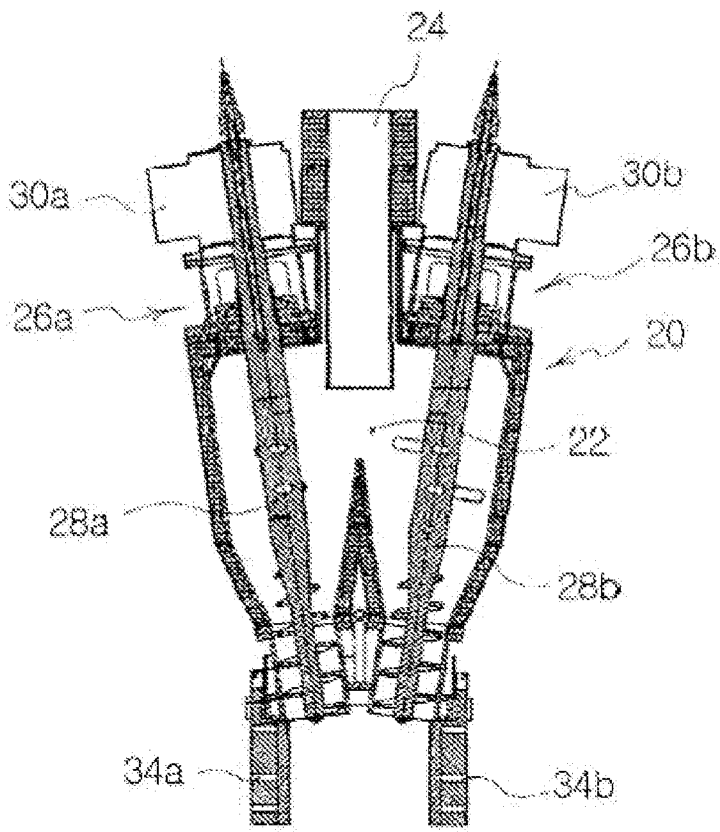
【FIG. 1】



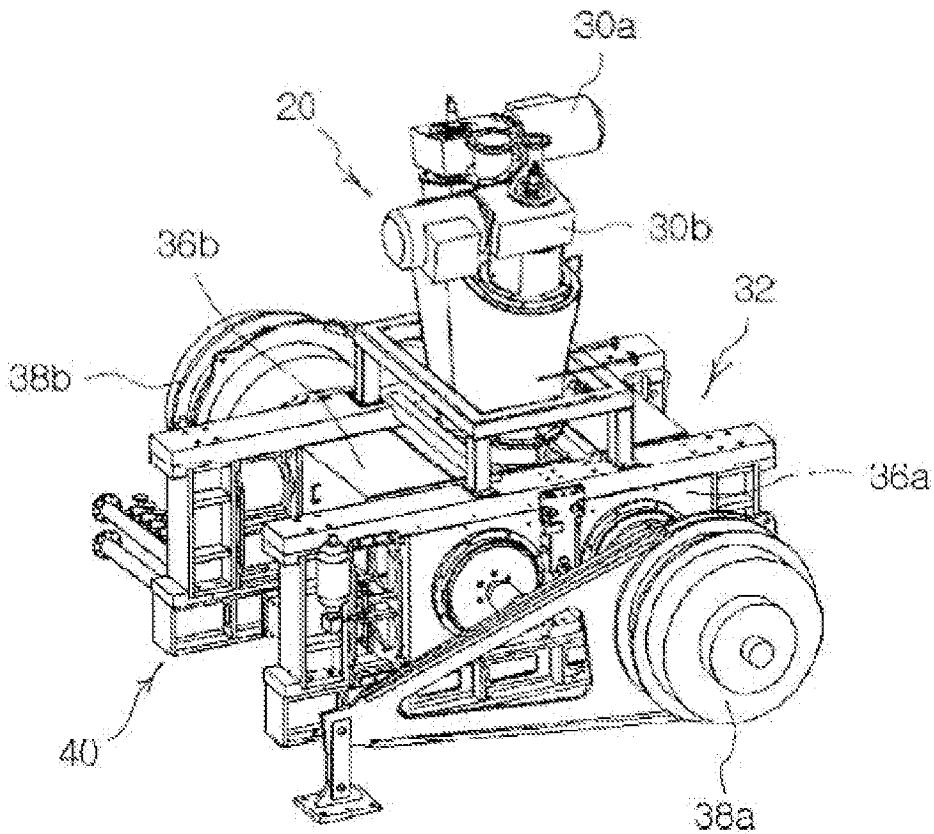
【FIG. 2】


transfer block valve (7)
hot press part (32)
first hot crushing part (50)
second hot crushing part (120)
hot transferring part (150)
nitrogen gas
10
5
12
1
158
160
17
18a
18b
30a
20
30b
28a
28b
320
32
190
192
194
36a
36b
40
34a,34b
54
50
60
64
66a
66b
104
108
120
storage tank
86
100
115
130a
130b
170
340
88
82
80
156
150

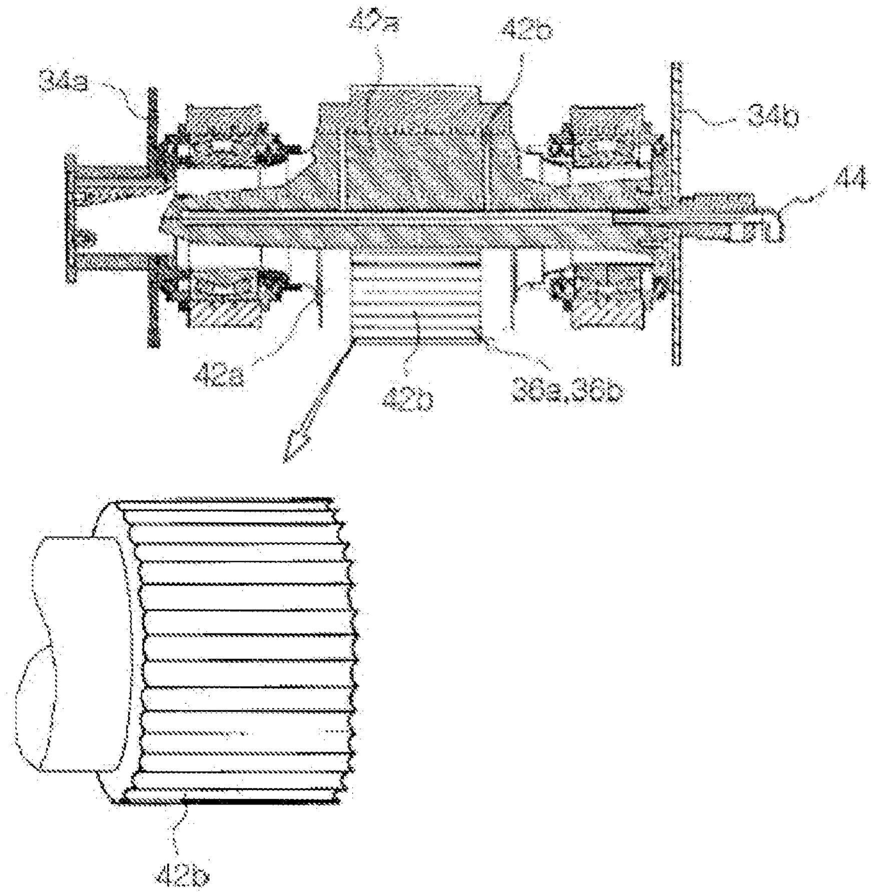
□yFIG. 3□z



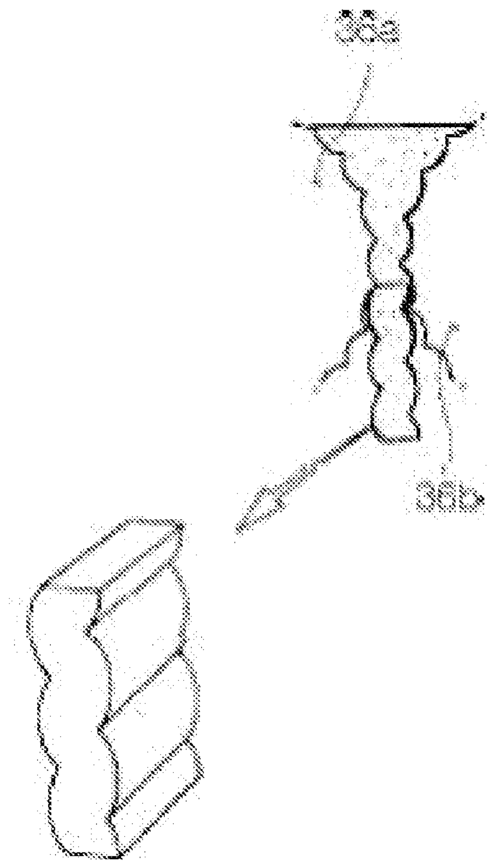
□yFIG. 4a□z



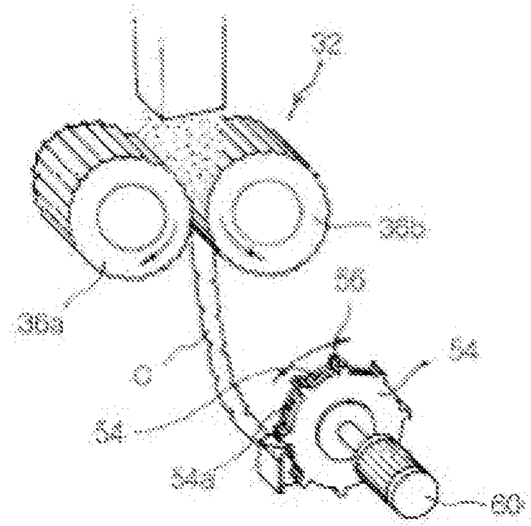
□yFIG. 4b□z



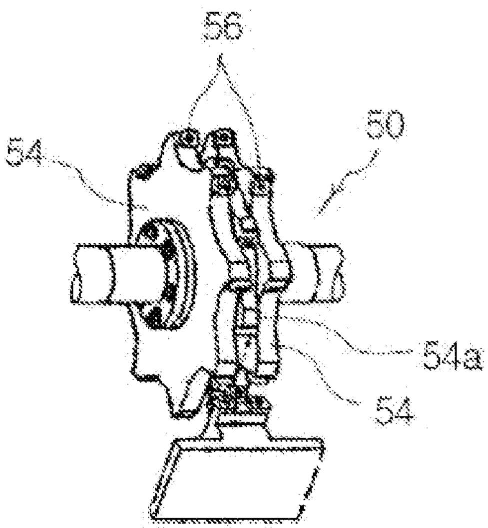
□yFIG. 5□z



□yFIG. 6□z

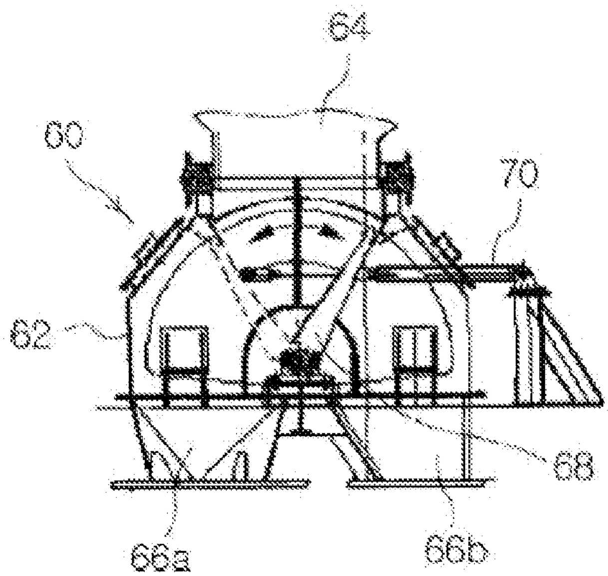


□yFIG. 7□z

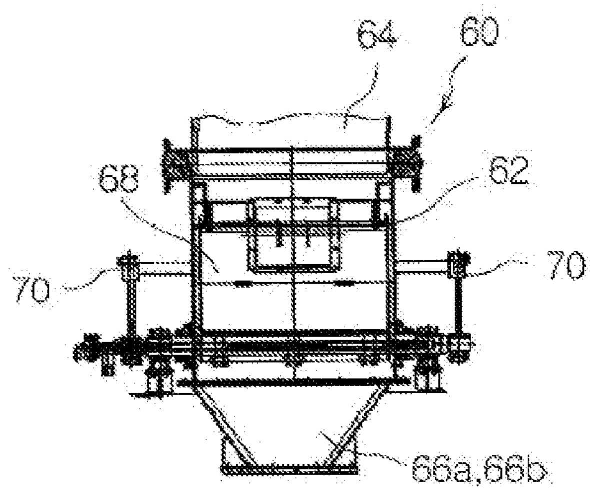


□yFIG. 8□z

(a)

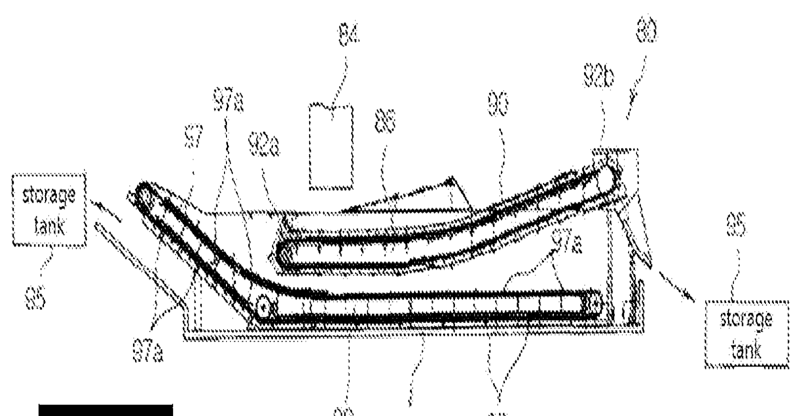


(b)

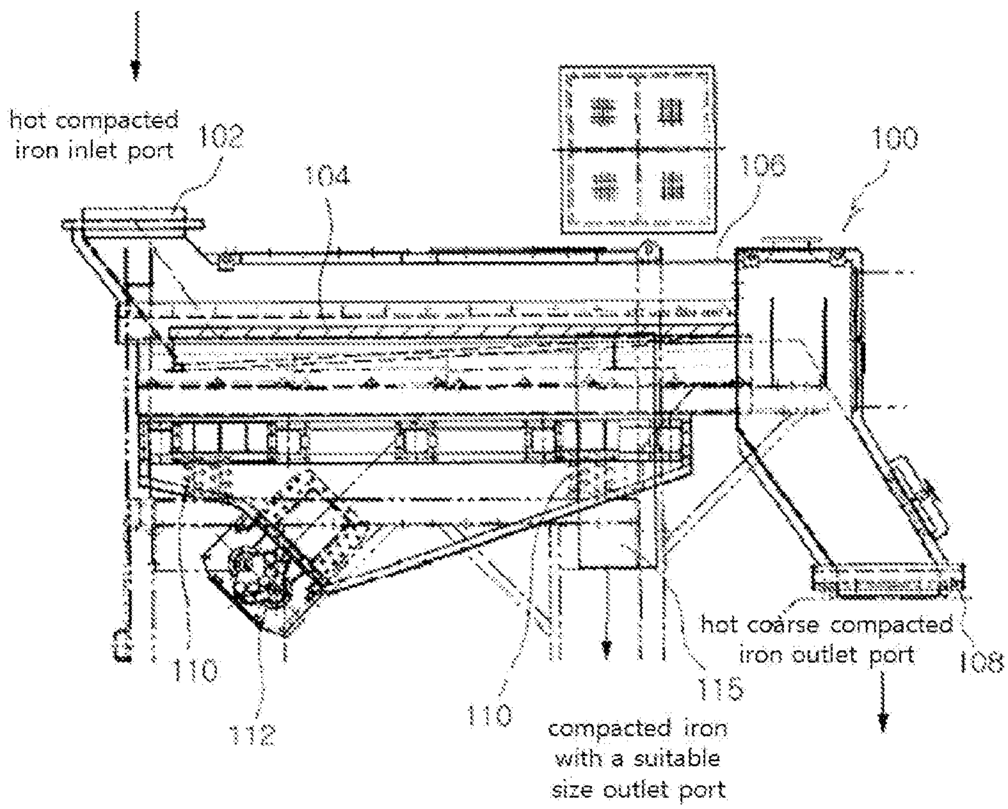


□yFIG. 9□z

[redacted]

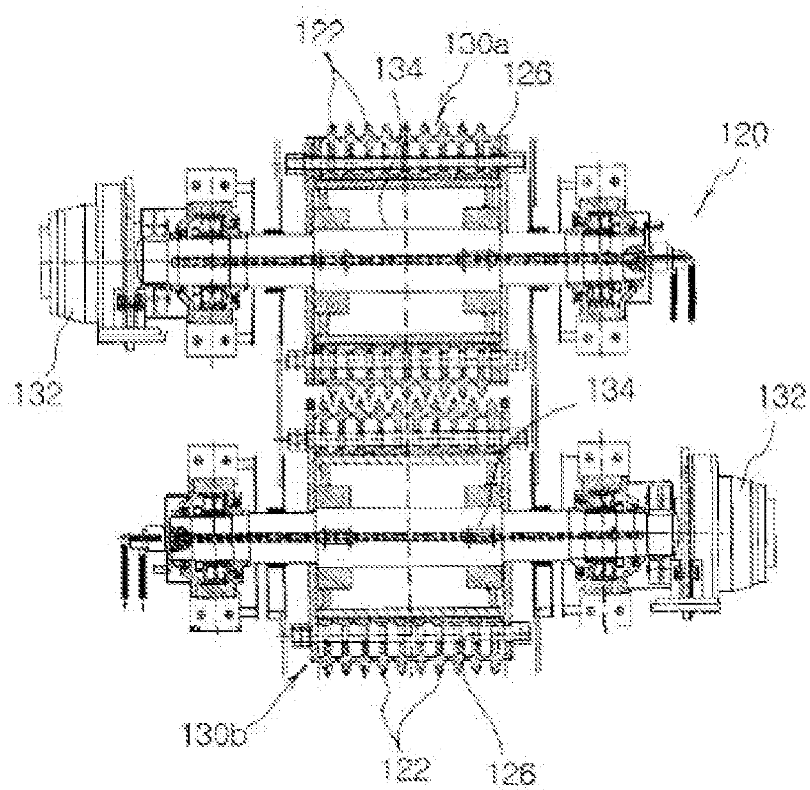


□yFIG. 10□z

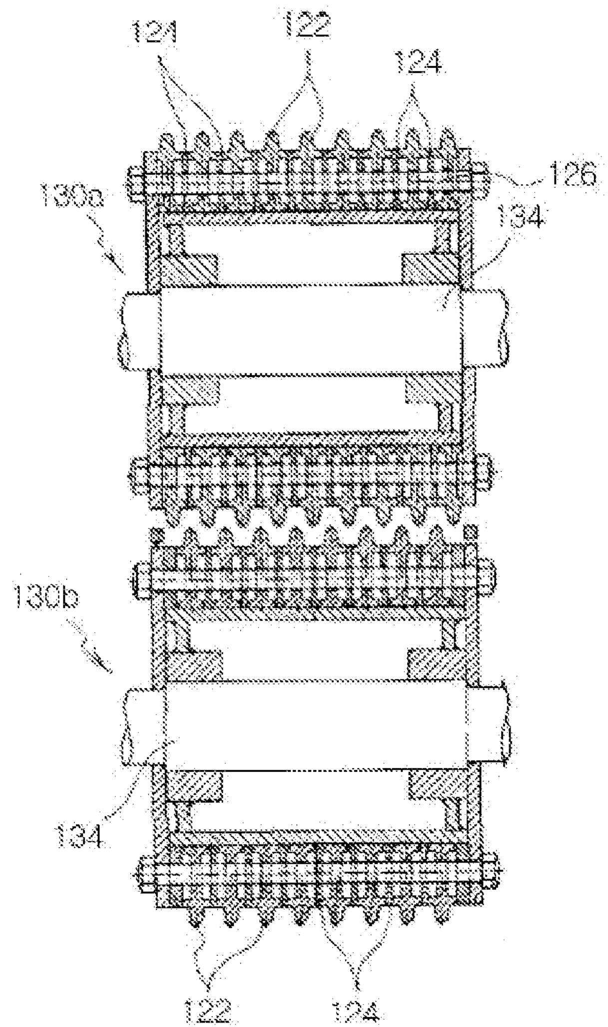


hot compacted
iron inlet port
102
104
106
100
hot coarse compacted
iron outlet port
108
110
112
110
115
compacted iron
with a suitable
size outlet port

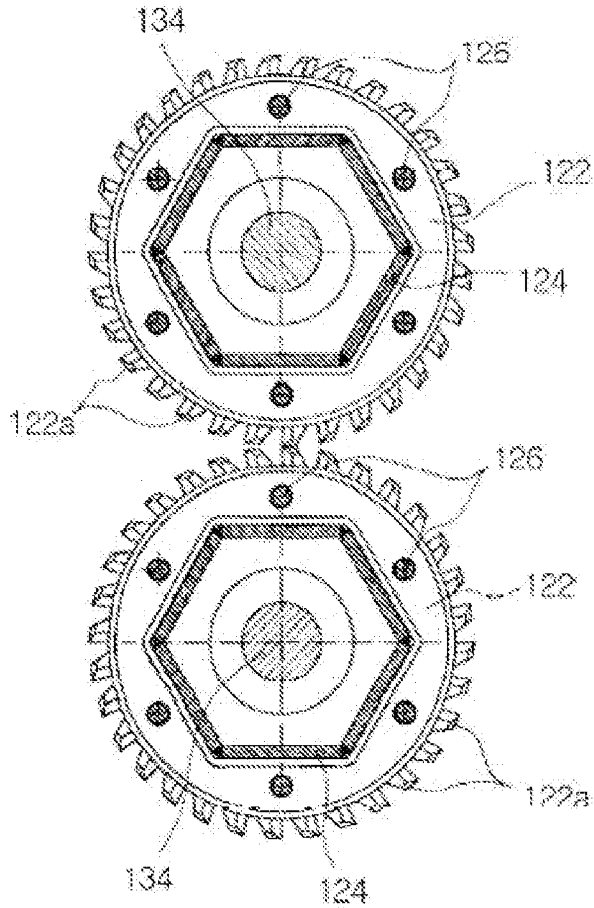
□yFIG. 11□z



□yFIG. 12□z



□yFIG. 13□z



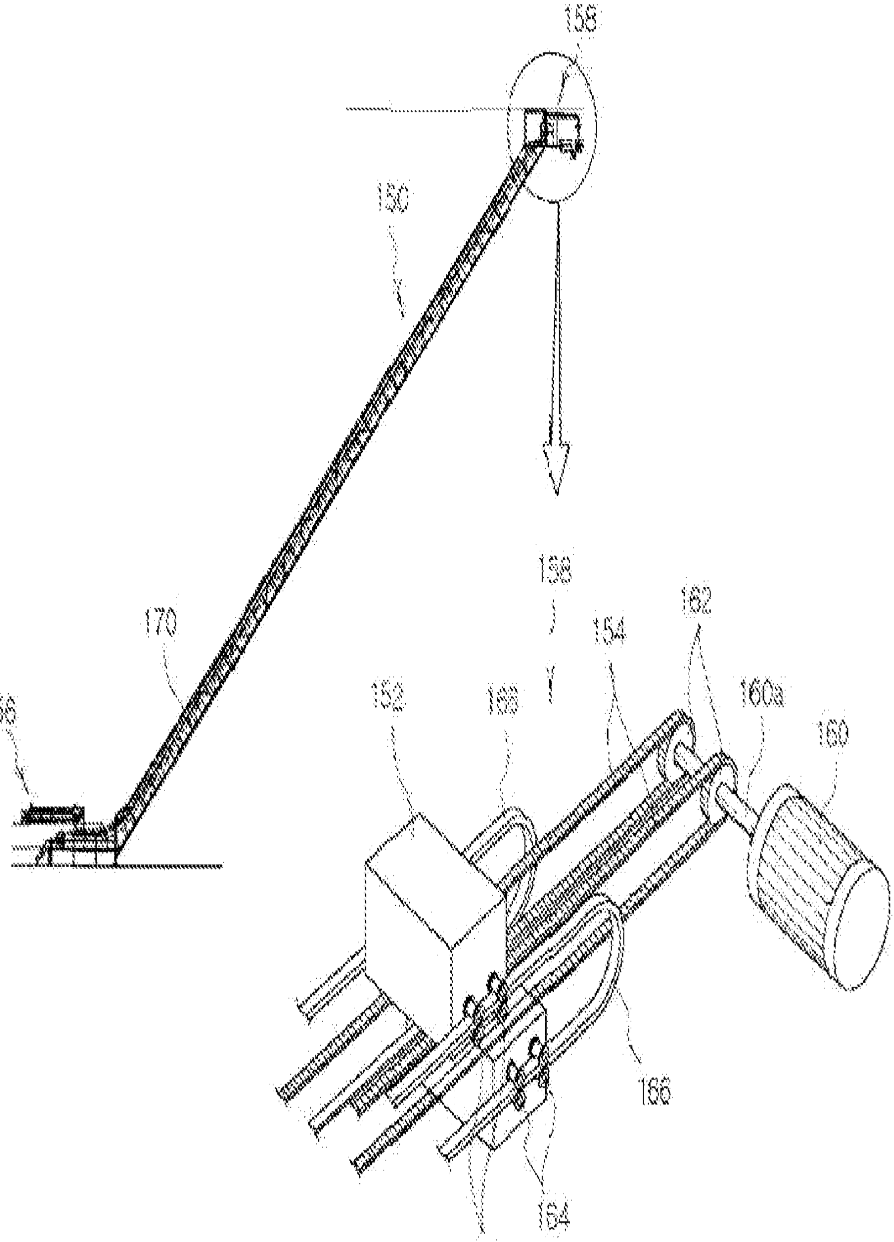


FIG. 14a

□yFIG. 14b□z

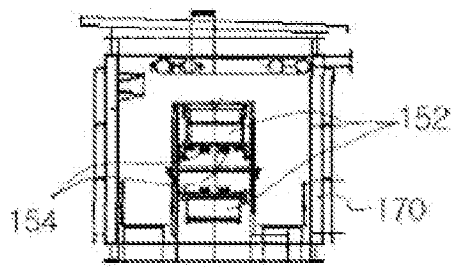
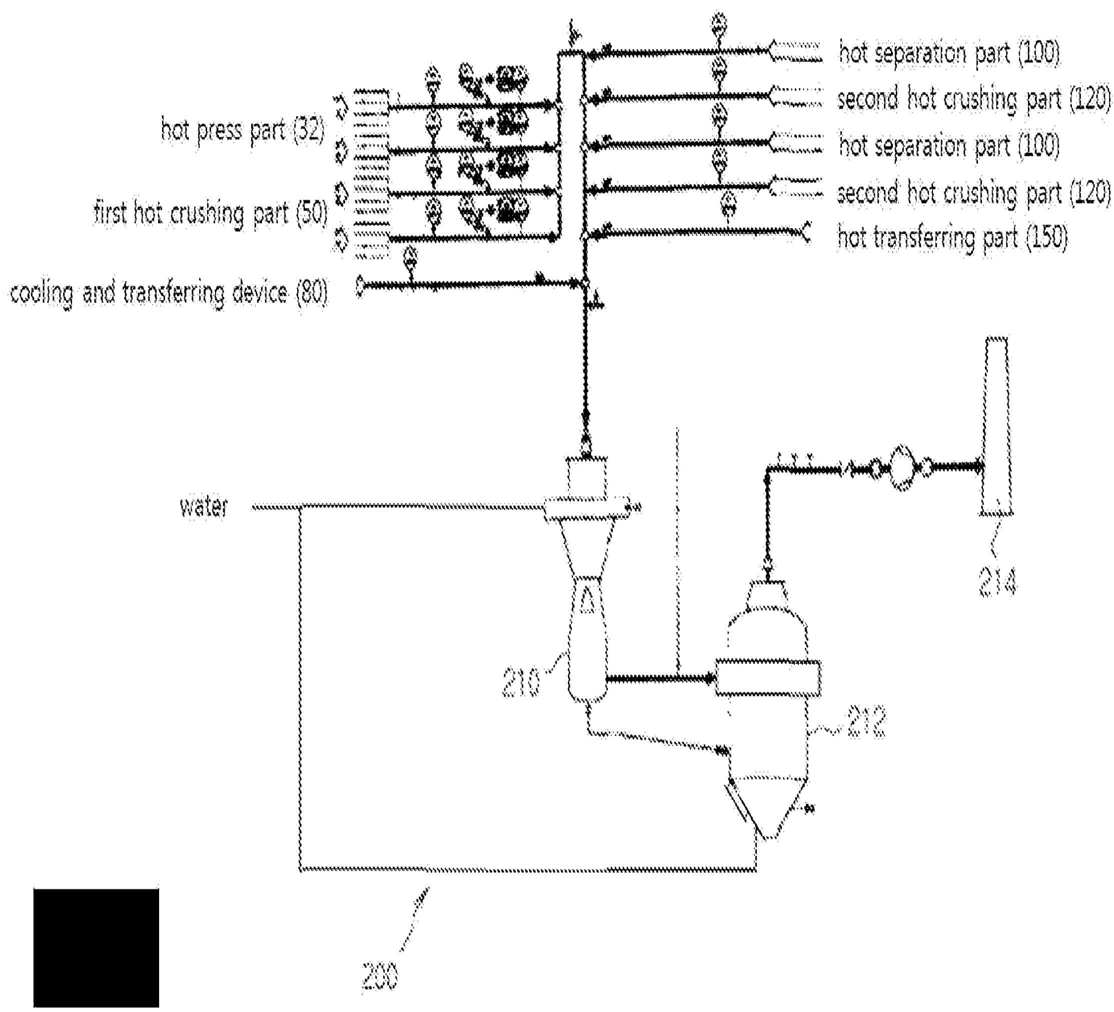
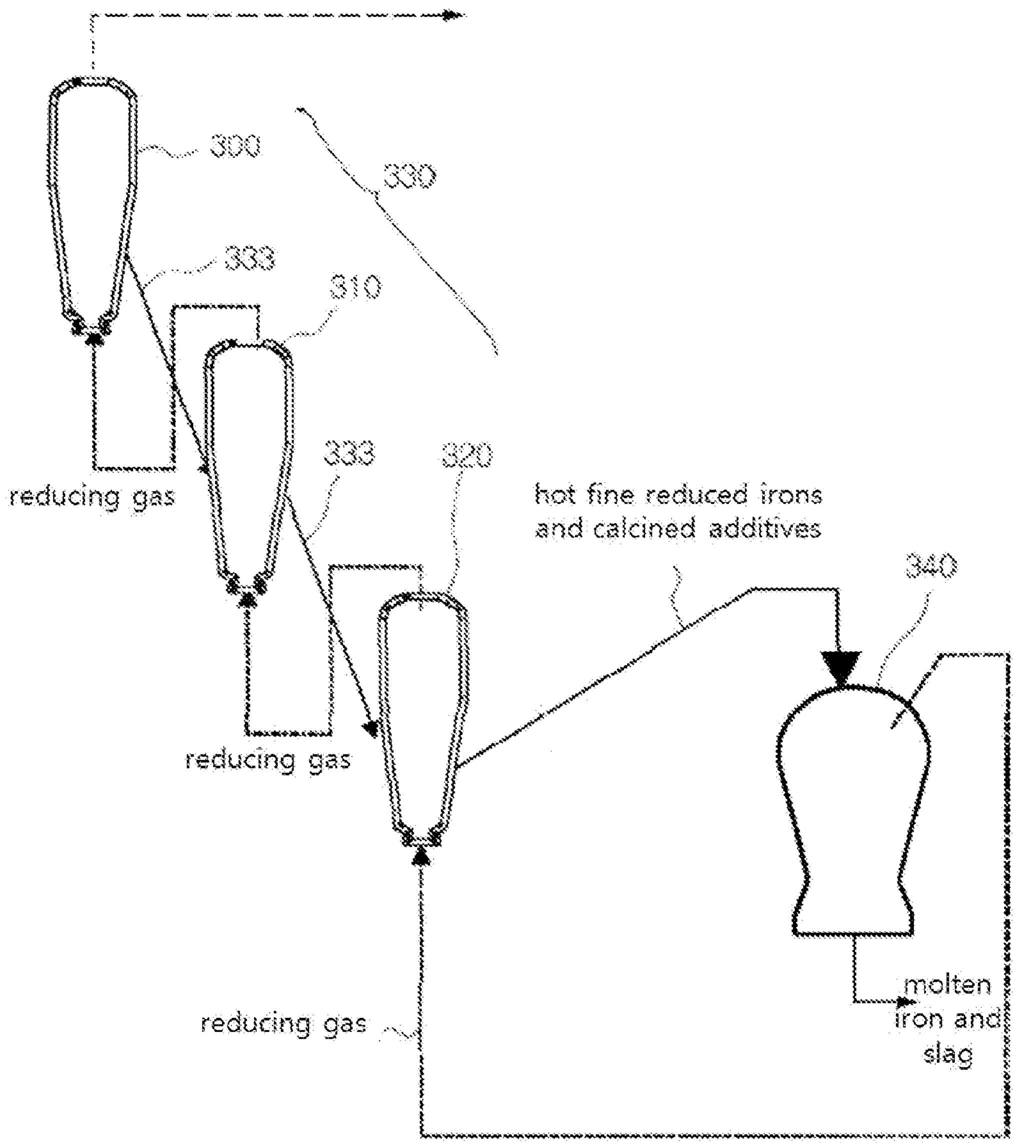


FIG. 15


hot separation part (100)
second hot crushing part (120)
hot separation part (100)
second hot crushing part (120)
hot transferring part (150)
hot press part (32)
first hot crushing part (50)
cooling and transferring device (80)
water
210
212
214
200

□yFIG. 16□z



300
330
333
310
reducing gas
333
320
hot fine reduced irons
and calcined additives
340
reducing gas
molten
iron and
slag
reducing gas

□yFIG. 17□z

density (kg/cm3)	grain size (%)				fraction (~1mm, %)
	20~30mm	10~20mm	0~10mm	계	
3.5~4.2	35	47	18	100	5